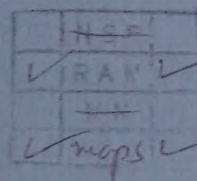


NEW SOUTH WALES

**DEPARTMENT
OF
AGRICULTURE**

ANNUAL REPORT

1971-1972



1972

PARLIAMENT OF NEW SOUTH WALES

REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE
Year ended 30 June, 1972

Ordered to be printed, 24 October, 1972

BY AUTHORITY

V. C. N. BLIGHT, GOVERNMENT PRINTER, NEW SOUTH WALES—1973

THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

20th October, 1972.

The Hon. G. R. CRAWFORD, D.C.M., M.L.A.,
Minister for Agriculture,
Sydney.

Sir,

I have the honour to present a report reviewing the activities of the Department of Agriculture for the year ended 30th June, 1972.

The form of the report has been changed. In previous years it was arranged by units of the Department. This year's report is under functional rather than organizational headings.

R. M. WATTS,
Director-General.

ARRANGEMENT OF THE REPORT

ORGANIZATIONAL CHART

SENIOR ADMINISTRATIVE PERSONNEL

SALIENT ITEMS FROM THE REPORT

Section

1 THE RURAL INDUSTRIES OF N.S.W. 1971-72

2 ADMINISTRATION

3.1 RESEARCH ADMINISTRATION

3.2 RESEARCH ACTIVITIES

4 EXTENSION

5 EDUCATION

6.1 REGULATORY AND TECHNICAL SERVICES: PLANTS AND PLANT PRODUCTS

6.2 REGULATORY AND TECHNICAL SERVICES: ANIMALS AND ANIMAL PRODUCTS

6.3 MARKETING REPORTS AND RELATED SERVICES

6.4 GARDENS, DOMAINS, AND PARKS

Appendices

I ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1971-72

II PUBLICATIONS 1971-72



Digitized by the Internet Archive
in 2025

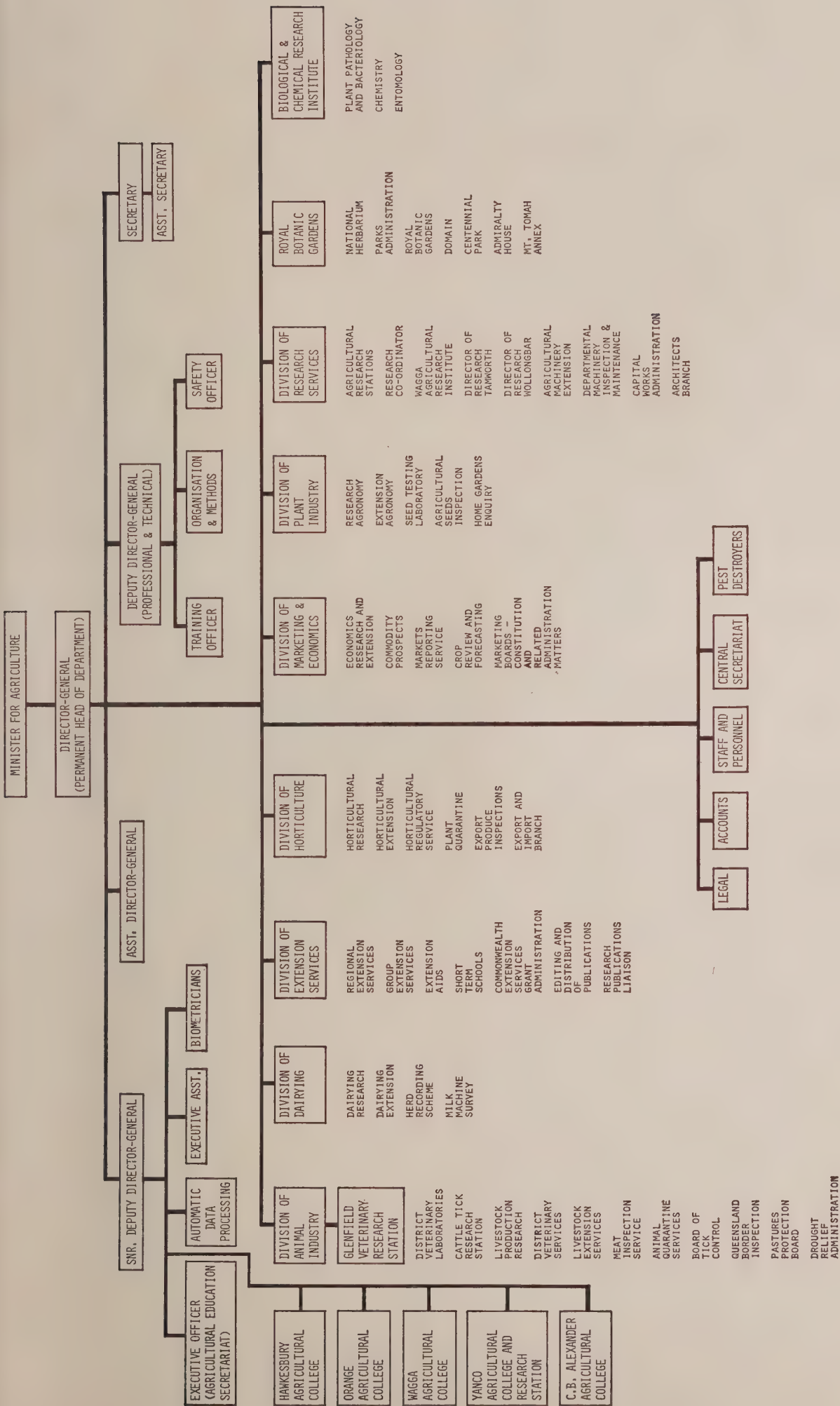
CONTENTS

	PAGE
ORGANIZATIONAL CHART	11
SENIOR ADMINISTRATIVE PERSONNEL	13
SALIENT ITEMS FROM THE REPORT	15
Section	
1 THE RURAL INDUSTRIES OF NEW SOUTH WALES 1971-72	18
THE INDUSTRIES	18
Wheat	18
Oats	20
Barley	20
Rye	20
Rice	20
Maize	21
Sweet Corn	22
Pop Corn	22
Grain Sorghum	22
Forage Sorghums	22
Millets	22
Leguminous Crops	23
Cotton	23
Sunflower	24
Rapeseed	24
Linseed	24
Soybeans	25
Safflower	25
Peanuts	25
Tobacco	25
Other Crops	25
Vegetables	26
Pastures	27
Fodder Conservation	28
Irrigation	29
Citrus Fruits	29
Pome Fruits	31
Strawberries	32
Stone Fruits	33
Nuts	34
Tropical Fruits	35
Grapes	36
Sheep and Wool	38
Beef	39
Dairying	40
Pigs	41
Poultry	42
Honey	42
PEST INCIDENCE—GENERAL	43
Pasture and Field Crop Pests	43
Vegetable Pests	43
Queensland Fruit Fly	43
Stored Product Pests	44
Argentine Ant	44

Section	CONTENTS—continued	PAGE
2	ADMINISTRATION	45
	CENTRAL ADMINISTRATION	45
	Functions	45
	Accounts	45
	Office Accommodation	46
	Committees, Councils, and Trusts	47
	Australian Agricultural Council and Standing Committee on Agriculture, Farrer Memorial Trust, Royal Botanic Gardens, and Government Domain Trust.	
	Marketing Boards and Polls	48
	Legal Branch	49
	Automatic Data Processing	50
	Training	51
	Safety	51
	Organization and Methods	51
	State Office Block Library	52
	Special Papua-New Guinea Assignment	53
	Staff	53
	DIVISION OF EXTENSION SERVICES	54
	Functions, staff, new developments.	
	DIVISION OF ANIMAL INDUSTRY	56
	DIVISION OF DAIRYING	58
	DIVISION OF HORTICULTURE	60
	DIVISION OF PLANT INDUSTRY	62
	BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE	64
	BIOMETRICAL BRANCH	65
	DIVISION OF MARKETING AND ECONOMICS	66
	DIVISION OF RESEARCH SERVICES	67
	ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM	69
	AGRICULTURAL EDUCATION SECRETARIAT	71
3.1	RESEARCH ADMINISTRATION	73
	Research staff, training of scientific staff, new developments, research committees, visitors.	
3.2	RESEARCH ACTIVITIES	75
	HORTICULTURE AND HORTICULTURAL PRODUCTS	75
	Stone Fruits	75
	Pome Fruits	76
	Citrus Fruits	78
	Tropical Fruits	80
	Grapes and Wine	81
	Strawberries	82
	Ornamentals	82
	IRRIGATION AND DRAINAGE	83

Section	CONTENTS— <i>continued</i>	PAGE
3.2	RESEARCH ACTIVITIES— <i>continued</i>	
	CROPS AND CROP PRODUCTS	84
	Vegetables	84
	Tobacco	85
	Cotton	86
	Oil Seeds and Grain Legumes	86
	Wheat	88
	Oats and Barley	
	Maize and Sorghum	94
	Rice	95
	Pests of Stored Grains	96
	Plant Exchange	96
	PASTURES AND FORAGE CROPS	96
	LIVESTOCK AND LIVESTOCK PRODUCTS	102
	Sheep and Wool	102
	Beef Cattle	107
	Dairy Cattle	108
	Dairy Products	110
	Diseases of Cattle	111
	Pigs	113
	Poultry	114
	Bees	115
	RESEARCH IN BIOLOGY AND CHEMISTRY	116
	Virology in Animal Disease	116
	Noxious and Feral Animals	116
	Plant Ecology	117
	Systematics	117
	New Approaches in Entomology	118
	Pesticide Chemistry	118
	Water Quality	119
	Soil Survey	119
	Plant Nutrition	120
	Symbiotic Nitrogen Fixation	120
	Soil Microbiology	121
	Analytical Methods	121
	Electron Microscopy	122
	CLOUD SEEDING	122
	BIOMETRICAL RESEARCH	122
	AGRICULTURAL ENGINEERING	123
	Machinery, food storage, equipment for research.	
	SOCIAL RESEARCH	123
	Economics and Marketing	123
	Extension	124
4	EXTENSION	127
	EXTENSION STAFF	127
	TRAINING OF EXTENSION OFFICERS	127
	NEW DEVELOPMENTS	129
	ACTIVITIES OF EXTENSION OFFICERS	130
	EXTENSION PROGRAMMES	132
	EXTENSION THROUGH MASS MEDIA	133
	GROUP EXTENSION	135
	SERVICES FOR EXTENSION OFFICERS	136

Section	CONTENTS— <i>continued</i>	PAGE
5	EDUCATION	139
	ACHIEVEMENTS AND POLICY CHANGES	139
	COLLEGES OF ADVANCED EDUCATION	140
	CERTIFICATE COLLEGES	142
6.1	REGULATORY AND TECHNICAL SERVICES: PLANTS AND PLANT PRODUCTS	145
	REGULATORY SERVICES	145
	Plant Diseases Act	145
	Fruit Cases Act	146
	Horticultural Stock and Nurseries Act	147
	Potato Growers' Licensing Act	147
	Quarantine Act	147
	Commerce (Trade Descriptions) Act	150
	Pest Destroyers Act	151
	Fertilizer Act	151
	Agricultural Seeds Act	152
	TECHNICAL SERVICES	152
	Seed Production	152
	Seed Testing	153
	Inoculants Research and Control Service	153
	Noxious Plants	153
	Plant Disease Forecasting Service	153
	Plant Health Diagnostic Services	154
	New Plant Diseases	154
6.2	REGULATORY AND TECHNICAL SERVICES: ANIMALS AND ANIMAL PRODUCTS	155
	REGULATORY DISEASE CONTROL	155
	ANIMAL HEALTH DIAGNOSTIC SERVICES	160
	CATTLE TICK AND TICK FEVER CONTROL	161
	DAIRY INDUSTRY	163
	Dairy Industry Act and other Acts, code of practice for dairy buildings, herd recording, quality control.	
	ANIMAL QUARANTINE	165
	MEAT INSPECTION	166
	NOXIOUS ANIMALS	167
	PESTICIDE RESIDUES	167
	QUEENSLAND BORDER CONTROL	168
	LEGISLATION	168
	APICULTURE	170
	MISCELLANEOUS SERVICES	170
6.3	MARKETING SERVICES AND SERVICES TO OTHER ORGANIZATIONS ..	173
	MARKETING REPORTS AND RELATED SERVICES	173
	SERVICES TO OTHER DEPARTMENTS AND ORGANIZATIONS	173
6.4	GARDENS, DOMAINS, AND PARKS	175
	Royal Botanic Gardens, the Domains, Government House, Admiralty House, Centennial Park, Mount Tomah Annexe.	
Appendices		
I	ACCOUNTS OF THE DEPARTMENT FOR THE YEAR 1971-72	177
II	PUBLICATIONS 1971-72	187



SENIOR ADMINISTRATIVE PERSONNEL

As at 30th June, 1972

Minister	..	..	..	..	..	..	..	Hon. G. R. CRAWFORD, M.L.A.
Director-General	..	..	..	..	..	..	..	R. M. WATTS
Senior Deputy Director-General			..	..	..	..	..	Dr F. C. BUTLER
Deputy Director-General		..	..	..	..	..	..	B. OWEN FRENCH
Assistant Director-General	..	..	..	..	..	..	..	Dr R. B. DUN
Secretary	..	..	..	..	..	..	..	J. L. HAGER
Assistant Secretary	..	..	..	..	..	..	..	J. J. McCORMICK
Accountant	..	..	..	..	..	..	..	E. A. BRAGG

Chiefs of Divisions:

Animal Industry	..	..	..	..	..	..	R. A. HALL
Dairying ..	..	..	..	..	..	..	Dr G. J. SMITH
Horticulture	..	..	..	..	..	..	G. R. GREGORY
Plant Industry	..	..	..	..	..	..	L. R. KAVANAGH
Marketing and Economics		..	..	..	..	..	P. C. DRUCE
Extension Services	..	..	..	..	..	..	B. D. AMENT
Research Services	..	..	..	..	..	..	K. E. HUTTON
Executive Officer (Agricultural Education)				..	..	..	J. E. JESSUP

Principals, Colleges of Advanced Education:

Hawkesbury Agricultural College	..	..	..	..	..	Dr F. G. SWAIN
Wagga Agricultural College	..	..	..	..	..	B. F. ATKINS
Chief Biometrician	..	..	..	..	..	E. A. ROBERTS
Director, Biological and Chemical Research Institute	..	..	..	..	..	T. H. JOHNS
Director and Chief Botanist, Royal Botanic Gardens and National Herbarium	..	..	..	..	..	Dr L. A. S. JOHNSON

SALIENT ITEMS FROM THE REPORT

1 THE RURAL INDUSTRIES OF NEW SOUTH WALES 1971-72

Production of wheat, oats, and barley was lower than in 1970-71. Dry weather prevented farmers from taking advantage of increased wheat quotas and the area sown was smaller than that sown in the previous year. The area sown to oats fell considerably while barley acreage increased.

Rice production was also lower than in the previous year due to the combined effects of curtailed acreage and lower yields.

Interest in summer crops continued to grow. The area and production of maize increased with relatively more of the increase from irrigated farms than from dry area farms. Both the acreage and production of grain sorghum were lower than in 1970-71. The Sorghum Marketing Board, operating for the first time, exported grain chiefly to Japan. The quantity exported was about half that of the previous season.

The cotton crop was a record 150,000 bales. The area sown was larger than previously following the lifting of restrictions on irrigation licences on the Namoi River and in response to favourable world market prices.

A consequence of unfavourable conditions for wheat at sowing time was a threefold increase in the area sown to the principal oil seed crops. The impressive increase came from sunflower, rape, and soybeans. Areas sown to safflower and linseed declined.

It has been a year of varied fortunes for the fruit industry. Production levels were high for nearly all fruit crops. Citrus production was expected to be a record, slightly higher than in 1970-71.

Pome fruit production was maintained at a high level and the industry faces over-supply unless the acreage of trees is further reduced. Grave financial difficulties continued for the canned deciduous fruit industry and a substantial stock-pile of unsold canned products has accumulated. A Tree Pull Assistance Scheme has been proposed to reduce the acreage of canning fruits.

The increase in wine grape production continued. A record quantity was processed by wineries. The area of wine grapes has doubled since 1965 and there is a strong possibility of over-production by the 1974 vintage. Satisfactory disposal of the record dried vine fruit crop was possible because a poor Californian crop in 1972 reduced supplies on the world market.

The outstanding changes in the livestock industries were a decline of 12.2 per cent in the number of sheep, largely as a response to low wool prices, and the related increase of nearly 19 per cent in the number of cattle. The net effect after allowing for reduced sheep numbers was that stocking intensity reached an unusually high level.

Efforts to increase efficiency in the wool industry included investigation of the practicability and economics of new systems of objective measurement of wool and sale by sample. In other marketing developments, the N.S.W. Legislative Assembly appointed a Select Committee to investigate the meat industry and the Minister for Agriculture approved of action being taken to hold a poll to decide whether a sheep meats marketing board should be set up in New South Wales.

The trends of recent years continued for a growing pig industry, a dairy industry with fewer and larger units and an egg industry in difficulties resulting from high production. The number of breeding sows was estimated to have increased by 31 per cent as expansion of the pig industry continued. The number of registered dairies declined by 11 per cent and the number of factories also declined further. The egg industry remained depressed because of production higher than local demand.

2 ADMINISTRATION

The functions, staffing aspects, and administrative developments of each of the major Divisions and other components of the Department are reviewed in section 2 of the report beginning with Central Administration.

Total expenditure of the Department for 1971-72 was \$40,650,981 comprising \$23,797,174 from Consolidated Revenue Fund, \$1,435,000 from General Loan Account and \$15,418,807 from Special Deposits Accounts (details of the Department's accounts are given in appendix 1). Included in this amount was an expenditure on capital works of \$2,284,852. Staff establishment positions as at 30th June, 1972, totalled 4,026.

Two special overseas assignments were conducted by senior officers. At the request of the Commonwealth Government Dr F. C. Butler, Senior Deputy Director-General, visited Papua-New Guinea to review and report on the agricultural training programmes of the P.N.G. Department of Agriculture, Stock and Fisheries. In the New South Wales Government 1972 Trade Mission to South-East Asia the Department was represented by Mr P. C. Druce, Chief, Division of Marketing and Economics.

Important new appointments and changes in organization of the Department were made during the year. Dr R. B. Dun was appointed to the new position of Assistant Director-General with responsibility for the direction of research within the Department.

The former Division of Research Stations was restructured as the Division of Research Services and Mr K. E. Hutton appointed as chief. The Division includes a research administration section comprising the Research Co-ordinator and staff at three regional research centres.

In October, 1971, the former Division of Information Services was merged with the Division of Extension Services.

A seed production section within the Division of Plant Industry was established in January, 1972, to consolidate the various seed production activities of the Division.

There was a marked increase in the Department's administrative responsibilities under the Marketing of Primary Products Act. Polls were conducted which led to the constitution of the Barley Marketing Board and of the Oats Marketing Board. Preparations were made for the taking of polls for the constitution of three further marketing boards for oilseeds, sheep meats, and seed cotton.

Legislation passed during the year, and with which the Department was concerned, included the Wheat Quotas Act, 1971, the Egg Industry Stabilization Act, 1971, the Plant Diseases (Amendment) Act, 1971, the Meat Industry (Amendment) Act, 1972, and the Meat Industry Authority (Amendment) Act, 1972. A major revision of the Agricultural Seeds Act was prepared and a revision of the Marketing of Primary Products Act, 1927, was commenced.

3 RESEARCH

A programme has been adopted to decentralize the Department's research activities. Four regional centres have been proposed, each with a Regional Director of Research. Directors of Research will be appointed on some of the larger Research Stations.

The 360 scientists were engaged on a comprehensive range of projects. The direction of research was changed in many areas to meet changing needs of the agricultural industries. For example, much greater emphasis was placed on research into the production of oil and protein crops, particularly rapeseed, soybeans, sunflowers, and lupins. In horticulture, investigations associated with increasing orchard planting densities were intensified and facilities for research in winemaking were established.

The increased attention to research on oil seeds and grain legumes was directed to meeting the demand for information on cultivars, sowing time, sowing rates, fertilizer requirements, and pest and disease control.

In research on horticultural products the aims of projects included the improvement of quality and acceptability to consumers, for example the solution of post-harvest problems, the reduction of production costs and the improvement of efficiency of production.

A notable change in biological research was the expansion of research into the biological and ecological control of soilborne plant pathogens. There was increased emphasis in entomology on the development of the integrated pest control concept with the investigation of new approaches, largely non-chemical, to insect control.

Grazing studies with sheep at research centres throughout the State have as their objective an understanding of the principles involved in the performance of grazing livestock. Once these principles are defined their application will lead to more efficient use of pastures. Grazing studies with beef cattle at Grafton are producing information of immediate value to the beef cattle industry.

Research in dairy products includes co-operation with dairy companies in the development of new dairy based foods which would assist the industry in diversification. One new product is ready for marketing. These specific investigations are being supported by studies of milk components.

In response to recent changes in relative prices of agricultural products and the availability of markets, the emphasis in economics research has been given to possibilities for enterprise adjustment on farms in the various regions of the State.

4 EXTENSION

The Public Service Board approved an upgrading of the status of the Department's regional supervisors and will undertake a review in May, 1973. The change of grading was consistent with the leadership, supervisory, training, and administrative responsibilities of the supervisors.

A variety of in-service training opportunities assisted extension officers to acquire and maintain the technical and extension competence needed to meet the changing demands on their services. In addition, 18 officers engaged in formal post-diploma or post-graduate study and 25 were enrolled as external students at Macquarie University and the University of New England.

Co-ordination of State services concerned with rural adjustment was improved by the establishment of a Standing Committee on Rural Adjustment including representatives of five departments. Regional interdepartmental Rural Adjustment Committees, convened by regional supervisors, will assess adjustment needs, co-ordinate adjustment activities and initiate educational programmes and other services for rural communities.

Farmers showed increased interest in information on marketing, commodity prospects, and alternative enterprises to wool and wheat. Extension officers responded to this interest and also increased the provision of information to staff of financial and commercial organizations servicing agriculture.

Changes in the rural economy, market outlooks, and the types of information requested by farmers resulted in changes in the pattern of activities of nearly all the Department's 285 extension officers and of the officers responsible for supervising, supporting, and servicing them. Especially in the sheep industry, technical recommendations had to be strongly oriented to economic aspects and the whole farm. The trend towards greater emphasis on extension in farm business management continued and was assisted by increased teamwork between regional economists and other extension officers.

5 EDUCATION

The total enrolment of 575 students at the Department's four agricultural colleges in 1972 was the highest ever. It indicated acceptance of the increasing opportunities for agricultural education at the post secondary level despite the economic difficulties of primary producers.

Hawkesbury and Wagga Agricultural Colleges were gazetted as colleges of advanced education from 1st January, 1972, and all diploma courses at the two colleges were approved as courses of advanced education in terms of both State and Commonwealth legislation.

Setting of the second major contract for buildings at the new Orange Agricultural College assured the objective of initial enrolment of students in 1973. Negotiations were commenced for the status of a college of advanced education for this college.

The courses at the certificate colleges—the C. B. Alexander and Yanco Agricultural Colleges—continued to provide intensive management training for young men and women who intend to return to the land.

6 REGULATORY, TECHNICAL AND OTHER SERVICES

Major amendments to the Plant Diseases Act have widened the scope of the Act, provided for simplified procedures in issuing orders for compulsory control of specified pests and diseases and introduced new procedures for dealing with breaches of grading regulations for fruit and vegetables.

Increased attention has been given to infestations of stored product pests in close proximity to Grain Elevators Board receiving depots.

There was an increased incidence of Queensland fruit fly throughout most of the State.

The sale of some 2,000 cases of interstate apples which had been marketed too early and of 950 cases of immature grapes was prevented.

Quarantine interceptions included the important stored-product pest Khapra beetle, which is not present in Australia.

Regulations for the implementation of the Fertilizers (Amendment) Act were gazetted on 28th April, 1972. Provisions of the Act, which will come into force on 1st January, 1973, include the expression of phosphorus and potassium as the elements and not as P_2O_5 and K_2O .

Fifteen cwt of certified basic seed of the free-seeding kikuyu cultivar, Whittet, was produced during the year and used to establish 3,000 acres for commercial seed production. Certified seed will be available in quantity in August, 1972.

The mastitis control programme involving thirty-five demonstration herds was continued into the third and final year. The results will be used as a basis for an intensive extension programme in mastitis control.

Cattle tick infestation in the northeast of the State continued to cause concern because of resistance to the common methods of control.

The most severe outbreak of plague locusts for 17 years in the Western Riverina and southern part of the Western Division was successfully brought under control.

NOTE

In section 1 of this report some production and livestock figures are quoted as preliminary estimates—the best data available at the time that the report was compiled. In some cases final statistics will be available at a later date from publications of the Bureau of Census and Statistics.

1. THE RURAL INDUSTRIES OF NEW SOUTH WALES 1971-72

THE INDUSTRIES

WHEAT

Acreage and Production

Preliminary figures for the 1971-2 season indicate that 5,500,000 acres of wheat were sown for a production of 86,000,000 bushels at an average yield of 15·6 bushels per acre. The area was lower than farmers originally intended because of the dry autumn and the yield per acre was lower than average because of late sowings in many areas and the dry spring. Although wheat delivery quotas were raised above the figures for the previous 2 years, production did not reach that of either of the two previous years because of the adverse season.

Deliveries to the Wheat Board in N.S.W. totalled about 71,500,000 bushels.

The official quality standards and production for the 1971-2 harvest were (previous year's bushel weights in brackets):

<i>Grade</i>	<i>lb per bushel</i>	<i>Approx. totals (million bushels)</i>
N.S.W. Prime Hard No. 1 (minimum 15 per cent protein)	63 $\frac{3}{4}$ (63)	9
N.S.W. Prime Hard No. 2	63 $\frac{1}{2}$ (63)	6
Northern Hard	63 $\frac{3}{4}$ (63)	2 $\frac{1}{2}$
N.S.W. Southern Hard (Falcon and Eagle) ..	63 $\frac{1}{2}$ (63)	2
Northern F.A.Q.	63 $\frac{3}{4}$ (63)	7
Southwestern F.A.Q.	62 $\frac{3}{4}$ (62)	35

(All standards determined on official Schopper scale.)

In addition to the above six grades, the Wheat Board marketed wheat grown in the 1971-2 season in New South Wales under a further five categories:

<i>Category</i>	<i>Approx. totals (million bushels)</i>
Durum No. 1 and No. 2, together	$\frac{1}{2}$
Soft biscuit wheat	1 $\frac{1}{2}$
Northern off-grade and inferior, and southern-western off-grade and inferior, together	8

Both bushel weight and protein content of the main grades this season were higher than in the previous year.

Premium Wheats

Premiums were paid or contracted by local and overseas buyers on a total of 20,037,620 bushels of wheat grown in the 1971-2 season.

Local flour millers paid premiums on a total of 5,228,625 bushels of bread wheat as compared with 5,134,600 bushels in 1970-1.

Premiums totalling \$18,619 were paid on 94,119 bushels of the durum variety Dural.

Soft wheat varieties commanded a total premium of \$59,893 on 1,245,506 bushels.

The most popular hard bread wheat varieties, gauged by quantities accepted for local premiums were Timgalen (284,000 bushels), Gamut (68,000 bushels), and Gatcher (24,000 bushels). The soft biscuit variety Pinnacle (1,151,000 bushels), accounted for almost 93 per cent of the soft variety deliveries for which local premiums were paid.

Popularity of Wheat Varieties

Variety statistics for the 1970-1 season (the latest season for which figures are available) show that Heron was still the most popular variety in New South Wales, although its percentage area has declined over the past few seasons. It occupied 19·1 per cent of the total area sown to wheat in 1970-1.

Although released only in 1967, Timgalen has increased rapidly in popularity and in 1970-1 was in second place with 15.6 per cent of the total area. Because of the increased emphasis on hard wheat in southern areas, Falcon increased in area to 10.4 per cent after a decline in popularity in the previous season.

The varieties Robin and Olympic increased in percentage area in 1970-1 while Gamut, Mendos, Festiguay, and Gamenya declined in popularity.

Wheat Variety Recommendations

The recently named rust-resistant variety Tarsa replaced Festiguay in northern dryland recommendations. Festiguay was deleted from recommendations because it is now susceptible to the most widespread strains of stem rust found in the northwest.

Summit, a soft wheat similar in most characteristics to Pinnacle is now recommended for southern irrigation sowings as well as in the better rainfall dryland areas of the centre and south.

Durum Wheats

Production of durum wheats is expanding. In the 1971-2 season durum wheat was sown on at least 40,000 acres for an estimated production of about 500,000 bushels. The previous highest area of 11,240 acres was sown in 1970-1.

1971 sowings comprised 8,000 acres of Dural yielding 96,000 bushels and 32,000 acres of Duramba, yielding 400,000 bushels. Protein content was mostly 15-16 per cent. Previous highest total production of durums was approximately 220,000 bushels in 1970-1.

The 1972-3 pre-sowing aim was for a production of 2 million bushels, but because of the dry weather during the sowing season the acreage sown will be well below that needed to achieve this goal.

The first Australian durum wheat standard was determined on 24th March, 1972, by the New South Wales Wheat Standards Committee. It was 64½ lb for approximately 400,000 bushels of the departmental variety Duramba which the Wheat Board will market locally and overseas.

Southern Hard Wheat Segregation

In 1971-2 segregation of the hard bread wheat varieties Falcon and Eagle at protein levels of 12 per cent and better was extended in southern N.S.W. and sowings increased. This type of wheat was segregated at fifty-nine stations in central and southern areas as compared with twenty-six stations in the previous season.

Two million bushels of Falcon/Eagle were segregated at an average protein content of 13.4 per cent. Seventy-five per cent of this has been sold to one overseas market at a premium of 10 cents per bushel. The remainder was sold locally for a premium of 5 cents per bushel. It seems reasonable to expect that this type of segregated southern hard wheat will be accepted on other world markets.

After segregating Falcon and Eagle, the southern-western F.A.Q. sample is more homogeneous. The presence of segregated hard wheats in the south has made more suitable varieties available to local millers and has saved them from hauling hard wheat from the north.

Weeds and Diseases

The most important weeds of wheat were skeleton weed (*Chondrilla juncea*), Wimmera ryegrass (*Lolium rigidum*), and wild oats (*Avena* spp.).

Take-all (*Gaeumannomyces graminis*) continued to be the most important root-rot disease in the wheat belt. Crown rot (*Fusarium graminearum*) was widespread in the north and on some heavy soils in the central and southern districts. Eyespot Lodging (*Cercospora herpotrichoides*) was again widespread throughout the eastern part of the southern wheat belt. Leaf Blight (*Septoria tritici*) was important in the southern districts.

The dry winter and early spring in northern N.S.W. prevented a build-up of stem rust (*Puccinia graminis tritici*) this season and losses in yield did not occur. In the southern districts, build-up of rust did not occur until late in the season. Heaviest losses in yield occurred on irrigated crops and on the late maturing variety, Pinnacle.

Leaf rust (*Puccinia recondita*) occurred throughout the southern and central districts, with lighter than normal infections occurring in the north. The only reports of losses in yield were on crops in the irrigation areas.

Loose smut (*Ustilago nuda*) was a common though generally unimportant disease throughout the wheat belt.

Bund (*Tilletia foetida* and *T. caries*) was severe in a few crops in the Wagga-Cootamundra district.

Frost damage caused severe losses in individual crops at Mudgee, Cowra, and Tumut. Early sown crops were most affected. Elsewhere frost damage caused very little loss in yield.

Hailstorms in the South West Slopes and Eastern Riverina during October caused widespread damage. Losses were also reported from Wellington and at West Wyalong. Lodging caused by wind and rain was reported.

OATS

Oat production in 1971–2 was estimated at 10,000,000 bushels, well below the 25,130,000 bushels obtained in the previous year.

Total sowings for all purposes were estimated at 1,300,000 acres of which 650,000 acres were harvested for grain for an average yield of 15.4 bushels per acre.

The area sown to oats in 1971–2 was the smallest for over 10 years mainly because of the dry autumn and the yield per acre was well below average because of the dry spring.

Cooba, the leading variety since 1965–66, occupied 35.7 per cent of the total area in the 1970–1 season (the latest season for which figures are available). The percentage area of Avon (13.7 per cent) remained about the same but Coolabah nearly doubled its percentage area and is now in third place with 9.9 per cent of the total area. The varieties Algerian, Belar, Fulghum, and Fulmark declined significantly in popularity while Bundy and Acacia showed slight decreases in percentage area.

Only minor changes were made in variety recommendations for the 1972–3 season. The very early maturing variety Irwin, bred in Western Australia, was included for grain production in low rainfall marginal areas. The crown rust resistant variety Camellia was included for green fodder production on the coast.

Smuts (*Ustilago* spp.) were widespread particularly in the southern areas where conditions were more favourable for infection and development of smut. Elsewhere losses were of minor importance.

Rusts (*Puccinia coronata* and *P. graminis avenae*) were recorded on many oat crops throughout the State but generally losses were small.

Frost damage caused serious losses in some areas particularly on early sown crops or when frosts followed heavy grazing. Damage occurred at Temora, Goulburn, and Bathurst. Serious weather damage occurred at Cowra where in one crop wind and hail caused a loss in yield of 60 per cent.

BARLEY

Total sowings of barley in 1971–2 for all purposes were estimated at 880,000 acres, an increase of 50,000 acres on the previous year and a record.

Production was estimated at 15 million bushels, a decrease from that of the previous season—mainly due to the adverse conditions. The yield of 19.5 bushels per acre was lower than the average for the previous 10 years.

In 1970–1, the last season for which final statistics are available, 11,288,000 bushels of two-row (malting) and 7,648,000 bushels of six-row types were harvested from 744,000 acres at an average yield of 25.4 bushels per acre.

Abyssinian maintained its place as the leading barley variety in the State in 1970–1 (the latest year for which figures are available) with nearly one-quarter of the total acreage. The only other major varieties were Prior which occupied 17.8 per cent of the total area and Research which occupied 14.1 per cent.

The only change in variety recommendations for 1972–3 was the addition of Ketch for late sowings in the lower rainfall areas. It has much higher yield and better straw strength than Noyep. The malting quality of Ketch is superior to that of Noyep and Prior.

Incidence of Diseases

Eyespot lodging (*Cercospora herpotrichoides*) was the most serious disease of barley in the 1971–2 season. Individual losses of 20 to 30 per cent occurred in crops at Cootamundra and Jugiong. Most crops south of Wagga were infected to some extent and light to moderate losses occurred. Six row varieties appear to be more susceptible than the two row types. Many farmers were unfamiliar with the disease and some had attributed the lodging to weather damage.

Take-all (*Gaeumannomyces graminis*) was widespread in southern areas but caused little losses in yield. Smut (*Ustilago nuda*) occurred as a light infection in many crops. Rust (*Puccinia graminis hordei*) was widespread on many irrigated crops around Finley but no losses in yield were reported.

RYE

The latest available production statistics are for the 1970–1 season when 28,957 acres of rye were sown for all purposes. Grain production was 305,682 bushels from a harvested area of 19,490 acres thus giving an average yield of 15.6 bushels per acre, which is above average. It is thought that the acreage sown to rye in 1971–2 was smaller than that in 1970–1 but that higher yields were obtained particularly in the Riverina.

RICE

At the request of the rice industry the 1971–2 crop at 91,173 acres, was about 4 per cent below the 1970–1 area of 95,315 acres. Production fell by almost 20 per cent to an estimated 233,300 tons. Thus average yields in 1970–1 and 1971–2 were about 2.98 and 2.56 tons per acre respectively.

The low average yield was due to a relatively cool season particularly around flowering time, the higher proportion of the crop sown to the lower yielding long-grain variety Kulu, and an increase in weed competition. Bloodworm (*Chironomus* spp.) damage was more severe than normal in the Murray Valley.

Principal Varieties and Millout

	1971		1972 Production (tons)
	Production (tons)	Whole Grain Millout %	
Calrose	178,130	61.8	139,400
Kulu	73,155	51.8	74,370
Caloro	32,383	49.0	17,710

It is expected that 1972 millouts for Calrose and Caloro will be similar to those achieved in 1971. Kulu will be somewhat lower.

Farmer scale seed increase areas of the long-grain varieties YR 13-89-9 and YR 13-89-11 and of the medium/long grain YR 6-100-9 were sown and yielded a total of 1,765 tons of grain. Commercial quantities will be sown in 1972-3.

MAIZE*Acreage and Production*

The area of maize in 1971-2 was estimated at 96,000 acres from which an estimated production of 5.5 million bushels was expected. Irrigated crops occupied about 43,000 acres (a 25 per cent increase on the previous year) and accounted for approximately 50 per cent of the total harvest.

Protracted wet weather on the North Coast helped the development of leaf blight which reduced yields and lowered grain quality. Rust also played a part. Better conditions inland resulted in above average yields and superior grain quality.

Expansion in the area of irrigated maize occurred principally in central and southern inland districts despite competition for area from grain sorghum and sunflowers in all irrigation districts (the returns from all of these crops are comparable).

State average yields were estimated at 2.25 tons per acre from irrigated crops and 1.25 tons per acre from dryland crops with top yields in the region of 3 to 4 tons and 2.5 tons respectively.

For the third season in succession grain surplus to local requirements was offered for export. Farm prices, which ranged between 85 cents and \$1 per bushel, were lower than obtained in the previous season and appeared to be related to Japanese market prices.

About 80 per cent of production in the coastal regions was used on the farms, mostly as hammer milled corn and cob meal.

Sydney based breakfast foods and starch manufacturers continued to absorb a large percentage of grain from inland producers. Apart from 5,000-6,000 tons of waxy grain, grown under contract for starch production, all grain was of the normal yellow dent type.

New Hybrids and Popularity Trends

Six new hybrids became available commercially: XL81, XL361, XL664, PX50, PX52, and H77. All were released by private organizations. Semi-dwarf hybrids, particularly XL45, maintained popularity in irrigated areas, while the departmental hybrids GH128 and GH390 occupied most of the coastal acreage.

Plant Populations

Plant densities between 20,000-24,000 per acre were usual in irrigated crops and produced high yields from the short-statured hybrids sown. Taller growing late-maturing hybrids were sown at 12,000-18,000 plants per acre, also with good results. Seed producers assisted growers to achieve correct plant populations by indicating details of grade and seed size on packages. New seed metering units were introduced from overseas and used by some growers with marked success.

Incidence of Diseases

Unusually wet seasonal conditions favoured the build up and spread of blights and rust. Susceptible varieties, particularly those grown in coastal areas, were severely affected. Rust (*Puccinia sorghi*) continues to be one of the most important and widespread diseases particularly in coastal and irrigated inland crops. Leaf Blight (*Drechslera turcica*) was rapid in its build up and spread and heavy losses occurred on susceptible varieties.

Leaf Blight (*Drechslera maydis*) was recorded for the first time in N.S.W. late in the season. The outbreak coincided with wet humid weather and occurred about a month after the disease was first recorded in Queensland. The race of the fungus present in Queensland and New South Wales is more pathogenic on varieties produced on Texas cytoplasm for male sterile lines. As most of the commercially available hybrids are based on Texas cytoplasm the N.S.W. Department of Agriculture is withdrawing, for the 1972-3 sowings, all seed based on this cytoplasm. Fortunately, there is probably sufficient seed available of the variety GH390, which is based on normal cytoplasm and appears to have good field resistance to *D. maydis*, to plant most of the 1972-3 coastal maize crop. By the following season it is hoped supplies of other popular hybrids based on normal cytoplasm will be available.

SWEET CORN

Approximately 4,000 acres of sweet corn were grown under contract to processors. The major part of the crop was canned as whole kernel corn though a developing demand for whole ears led to an increased quantity being quick frozen.

Rust, leaf blight, and maize dwarf mosaic lowered yields of late maturing crops. Protracted wet weather caused machine harvesting delays and resultant lowered quality. Earworm control measures were necessary on about half the area sown.

Yields in most districts varied between 3 and 6½ tons per acre.

Hybrid seed was the only type sown. NK195 increased in popularity over Iochief.

POP CORN

Pop Corn was grown under contract on approximately 600 acres. Local requirements were reduced because of good carryover stocks but Japanese demand for 400 tons resulted in increased irrigated production around Quirindi. Yields of 40–60 bushels per acre were obtained from the hybrids sown.

GRAIN SORGHUM

For the second year in succession a large part of the grain sorghum crop was grown on areas in the north of the State intended for wheat which were not sown because of the dry winter; approximately 90 per cent of the dryland crop was in the north. Irrigated crops accounted for about 17 per cent of the total area, which was estimated at 360,000 acres and for about 43 per cent of the total production, estimated at 11·4 million bushels. This was 36 per cent less than the previous season's production but was still the second largest N.S.W. crop on record.

Seasonal conditions were good early, but a dry autumn led to reduced and variable yields. Top dryland crops gave up to 3 tons per acre and irrigated crops up to 4·5 tons per acre with average yields of approximately 0·75 ton and 2 tons per acre respectively.

The Sorghum Marketing Board, operating for the first time, exported grain chiefly to Japan. Quality was good, but the quantity exported was only about 50 per cent of the previous season's total. More grain sorghum than usual was used locally for livestock feeding.

Bulk handling of grain on farms was the usual practice and farm grain drying increased. All exported grain was shipped in bulk through the Grain Elevators' Board facilities at Newcastle.

Twenty-three hybrids of differing maturities were available to growers, some as certified and others as uncertified seed. Hybrids of mid-season maturity were in greatest demand.

There was a trend towards mid-October to mid-November sowing in all districts. Growers were more conscious of the need for correct sowing techniques to produce good stands and increased yields. Irrigated crops were watered by furrow, corrugation, and spray methods with average densities of 80,000 plants per acre or approximately 8 lb of seed. Dryland sowings were made mostly in 14 in rows but there was a tendency to widen rows to permit cultivation for weed control. Average dryland population was 40,000 plants per acre.

Diseases of sorghum were generally of no importance in the 1971–2 season. Stalk rots (*Fusarium* spp.) and charcoal rot (*Macrophomina phaseolina*) were common late in the season but losses were negligible. Mosaic (maize dwarf mosaic virus) was widespread in some districts early in the season but most affected crops recovered and no instances of yield losses were reported.

FORAGE SORGHUMS

An estimated 100,000 acres of forage sorghums were sown. Piper Sudan was the only Sudan grass grown and then on only small inland areas, whilst the sweet sorghums, Saccaline and Early Orange were grown on a reduced area on the coast.

MILLETS

Broom Millet

The area sown to broom millet, estimated at approximately 1,100 acres, was the lowest for many years. Of this area about 600 acres were grown at Tumut and 300 in the Lismore district.

Seasonal conditions were generally adverse. Yields from crops harvested (many were not harvested) in all districts averaged about 8 cwt per acre and total production was estimated at about 6,000 cwt which would be the lowest figure for some years. Low production for the second year in succession resulted in increased prices with some top quality consignments bringing close to \$500 per ton.

Fodder and Grain Millets

Japanese and Siberian millets were popular for grazing and the acreage of pearl millets increased as seed was more readily available. The first hybrid pearl millet on sale, MX001, gave mixed results. Sowings of Setaria and White French grain millets were confined to the northwest. The 1,500 acres yielded about 400 tons for the bird seed trade. One sale of Setaria grain at \$100 per ton was reported from Inverell.

LEGUMINOUS CROPS

Cowpeas

Approximately 23,000 acres were sown to cowpeas, Caloona and Poona being the only varieties used. Inland sowings were estimated at 15,000 acres of which about 6,000 acres were harvested for grain, the remainder being grazed. Average yields from harvested crops were approximately 10 bushels per acre returning about \$3 per bushel to the grower. A small amount of grain was exported.

Mung Beans

Mung Beans were sown on approximately 4,000 acres mostly in the northern inland area where yields of 10 to 20 bushels per acre were obtained. Four Sydney-based companies absorbed some grain for production of sprouts to meet the increased local demand, while, for the first time, surplus grain was exported, chiefly to Taiwan. Only one variety, Celera, released by the Department in 1970, was grown, but seed supplies of an improved variety, Berken, were multiplied by the Department preparatory to release.

Lupins

Lupin sowings were estimated at 28,000 acres but adverse seasonal conditions resulted in only 18,000 acres being harvested for an estimated poor yield of 3,900 tons. Seventy-seven per cent of the production was in southern districts, where weed growth and a dry spring affected crops.

The sweet variety Uniwhite was the only cultivar sown. Grain produced was largely utilized for on-farm feeding with limited sales to local stock feed manufacturers. A trial container shipment was sent to Japan for assessment in formula feed use.

Brown leaf spot (*Pleiochaeta setosa*) was present in many southern crops but was not reported in northern areas. Infection levels were generally low.

Wilt (Broad bean wilt virus) was present in some crops during the spring but was not of great importance on a State basis.

Field Peas

The field pea area of approximately 3,000 acres was similar to that of the previous season. The variety Early Dun occupied 80 per cent of the total area, the remainder being sown to Derrimut. Four-fifths of the crop were grown in the Wagga region.

Winter weed growth and a dry spring resulted in many crop failures with average yields of 8–10 bushels per acre being harvested from only 50 per cent of the area sown.

Forage Crops

The area of vetches was estimated at 15,000 acres in 1971–2. Fifty per cent of this area was sown on the North Coast with the variety Golden Tares for grazing. The remaining fifty per cent of the area comprised the recently-released variety Namoi sown in inland districts as a self-regenerating annual on low fertility soils.

Approximately 14,000 acres of Dolichos bean were planted on the North Coast for summer/autumn forage purposes. The trend to Dolichos in place of cowpeas continued because of its better disease resistance.

COTTON

In N.S.W. in 1971–2 about 72,300 acres of cotton yielded a record crop of 150,000 bales for an average yield of 2.09 bales per acre.

Cool weather until late in the season generally retarded growth. Average temperatures rose towards the end of the season and the crop finished well to give a very satisfactory average yield. Quality was good with satisfactory micronaires. Most fibre was graded either middling or middling plus. Apart from red spider mite (*Tetranychus* spp.) insect activity was lower than normal.

In the Namoi Valley, 124,250 bales were picked from 58,100 acres for an average of 2.12 bales per acre.

On the Macquarie an estimated 13,000 acres were sown including some 2,500 acres of narrow row cotton. The estimated average yield was 1.8 bales per acre.

The Bourke crop more than doubled to 1,200 acres in 1971–2. Yields were good at slightly over 2 bales per acre. The cotton was ginned in the Namoi and Macquarie Valleys.

Four crops totalling under 100 acres were sown in southern N.S.W. The cotton was ginned at Darlington Point.

Deltapine Smoothleaf was the most widely sown variety though Deltapine 16 was sown on a larger area than previously. About 4,000 acres of Hopicala and a smaller area of Riverina Poplar were grown.

No bounty payments were made on the 1971–2 cotton crop. The record area was sown following the lifting of restrictions on irrigation licences on the Namoi River and in response to favourable world market prices.

Prototype strippers operated more successfully on narrow row cotton in 1971–2 than in the previous year but they were not able to harvest as rapidly as had been hoped.

SUNFLOWER

New South Wales sunflower production in 1971-2 was estimated at 120,000 tons from an estimated sowing of 750,000 acres. This was about three times the production of the previous year but because of adverse seasonal conditions the estimated average yield of 0.16 ton per acre was only about half that of 1970-1.

The massive increase in area reflected seasonal conditions. The dry autumn/early winter of 1971 resulted in farmers sowing less than their intended wheat acreage. Rains in late July and August encouraged sunflower sowings, particularly in the North Western and Northern Agricultural Regions where 80 per cent of the area was sown.

The decision to plant sunflowers was also influenced by active promotion from contracting companies and generally favourable sunflower yields in 1970-1 when summer rainfall was above average. Sunflowers were sown from late August until late February, half of the crop being sown by the end of October.

Yields were lowest in the northwest where many crops were not harvested. In the central west and in tableland districts, average yields were about 0.33 ton per acre. Irrigated yields were generally disappointing at about 0.5 ton per acre. An estimated 70 per cent of the crop had been harvested at the end of April. Mid-season crops generally gave the best yields and highest oil content.

Sunflower rust (*Puccinia helianthi*) was the only disease to cause significant losses, though other diseases including white blister rust (*Albugo tragopogonis*) were widespread. An unexplained head drop occurred in Tableland crops.

Isolated spraying was necessary to control Heliothis caterpillars (*Heliothis* spp.) and Rutherglen bugs (*Nysius vinitor*).

At the beginning of the season sunflower contracts were arranged by oilseed crushers at a price of about \$96 per ton, Sydney. A number of organizations also undertook to supply seed to overseas buyers, and with low average yields, and thus a reduction in anticipated production, an oversold position developed in New South Wales. This resulted in considerable competition between buyers, and some farmers were paid in excess of \$110 per ton on the farm.

The farmer-controlled Australian Coarse Graingrowers' Association handled most of the export shipments from N.S.W.

Common leaf rust (*Puccinia helianthi*) reached epidemic levels in northern crops late in the season. White blister rust (*Albugo tragopogonis*) occurred commonly on northern crops and late sown areas were severely infected. *Sclerotinia sclerotiorum* was also responsible for some losses in northern crops reaching infection levels of 30 per cent in some areas. Disease incidence was generally lower in the central and southern areas of the State.

RAPSEED

In 1971-2, rapeseed became the second most popular oilseed crop in N.S.W. It is estimated that 95,000 acres were sown as compared with 39,032 acres in 1970-1. Production in 1971-2 was estimated at 25,000 tons for an average yield of about 0.26 ton per acre.

Rapeseed sowings commenced in May/June in the wheat belt and were completed on the Tablelands by the end of October. Over 50 per cent was planted in the Mid-western and Southern Regions with significant sowings on the Southern and Central Tablelands. Yields in the wheat belt averaged about 0.25 ton per acre. Tableland yields were better.

Blackleg (*Leptosphaeria maculans*) was the only widespread disease. Losses exceeded 50 per cent in isolated cases. Aphis (several species) which had necessitated frequent control measures in 1970-1 were much less numerous in 1971-2 and few crops were sprayed more than once. The cabbage centre grub (*Hellula* spp.) attacked young plants in the spring. The most serious weeds were Wimmera ryegrass (*Lolium rigidum*) on the plains and fat hen (*Chenopodium album*) on the tablelands.

It is estimated that Target (*Brassica napus*) was sown on about two-thirds of the acreage. Arlo, a *B. campestris* type and Oro, a newly introduced low erucic acid *B. napus* type were sown to a lesser extent.

A Sydney based crusher purchased most of the N.S.W. rapeseed crop for a price of \$88 per ton Sydney. Export contracts were offered by two organizations and gave similar returns to growers. Very little seed was exported as there was a shortfall on the domestic market.

LINSEED

Linseed sowings were reduced from 50,751 acres in 1970-1 to an estimated 32,000 acres in 1971-2. Production was estimated at 7,000 tons compared with 16,917 tons in 1970-1.

Some 15,000 acres were sown in the Central West and 6,000 in the northwest. The other main area of production was the Southern Tablelands. High temperatures and drying winds in spring reduced yields in western crops, most of which had finished flowering by the end of October. Harvest commenced during November. The last crops were stripped in early April.

Red-legged earth mites (*Halotydeus destructor*) and *Heliothis* grubs (*Heliothis* spp.) were sprayed in many linseed crops. *Heliothis* were less active than normal.

Bonnydoon remained the most popular variety, although a small quantity of the new Victorian variety Glenelg was sown.

The contract price of linseed was reduced by \$15 per ton in 1971-2 to \$110 per ton Sydney. Following the favourable yields of 1970-1 there was a carryover of linseed and fewer contracts were negotiated.

SOYBEANS

It is estimated that a record 11,500 acres of soybeans were sown in N.S.W. in 1971-2. About 95 per cent of the area was irrigated. Total production was estimated at 8,500 tons giving a very favourable average yield of almost 0.75 ton per acre.

About 9,000 acres were sown to soybeans in the Gwydir, Namoi, and Macquarie River Valleys. Small scale sowings were made in southern irrigation areas, the Lachlan Valley and on the Northern Tablelands. About 400 acres were sown on the North Coast.

Bean quality was generally good although dry conditions at harvest caused some shattering and cracked grain.

Lee, Hill, and Bragg were the most commonly sown varieties. Wayne, Delmar, and Bethel were sown on a smaller area.

Prices in the vicinity of \$100 per ton Sydney were received for soybeans grown under contract. A small export shipment of the light-hilum variety, Delmar, was made at a premium price.

Rust (*Phakopsora pacyrhizi*) was recorded for the first time in N.S.W., at Lismore. Sclerotinia rot (*Sclerotinia sclerotiorum*) reached serious levels in some coastal crops but was rare in inland areas.

SAFFLOWER

The N.S.W. safflower area declined from a record 49,012 acres in 1970-1 to an estimated 38,500 acres in 1971-2. An estimated 6,300 tons crop was produced at an average yield of 0.145 ton per acre. In 1970-1 production was 8,160 tons. Dry conditions during autumn of 1971 had depleted subsoil moisture reserves, without which safflower-growing entails considerable risk.

Most safflower was sown in August and was grown on the central western plain. Successful trial sowings were made in the Western Division on drying lake beds. The varieties sown were Gila and Saffola 208. Crops were subjected to stress through dry October conditions but benefited from November and December rains. About 75 per cent of the crop had been harvested by the end of January. Grain was generally of satisfactory quality. The contract price was \$95 per ton, Sydney.

PEANUTS

An estimated 600 acres were sown to peanuts in 1971-2, an increase of 200 acres on the 1970-1 crop. Production is estimated at 260 tons. The N.S.W. industry has been traditionally located on the north coast but in 1971 trial crops were sown on the North West Slopes (200 acres) and under irrigation at Narrabri (40 acres). Results were generally unsuccessful but further sowings in these areas are anticipated.

TOBACCO

A survey by the Tobacco Leaf Marketing Board showed 3,140 acres were planted to tobacco in N.S.W. in 1971-2. Production amounted to 3.757 million lb for an average yield of 1,196 lb per acre. New South Wales thus exceeded its marketing quota of 3.057 million lb by 700,000 lb. This is the first time since quotas were introduced in 1965 that N.S.W. has produced over-quota leaf.

Most N.S.W. tobacco is grown in the Ashford/Inverell district but in 1971-2 there were 416 acres at Tamworth, 207 acres in southern districts, and 82 acres on the North Coast. A total of 126 farms had tobacco quotas.

Damping-off (*Rhizoctonia* sp.) was prevalent in seedbeds. Blue mould (*Perenospora tabacina*) became widespread later in the season but damage was slight. There was no serious insect damage. An estimated 95 per cent of growers used alcohol-based suckercides.

Leaf quality was generally good. The most widely grown variety was Q46, with smaller areas of NC95, Sirone, and various selections of Hicks. Weed control was generally successful, about 90 per cent of the total area being treated with a herbicide.

OTHER CROPS

It is estimated that 12 growers sowed trial areas of buckwheat in 1971-2. Yields were variable but an agent hopes to export 500 tons to Japan in 1972-3. The Sydney price is in the vicinity of \$60 per ton.

There is a trend towards denser stands of smaller bushes in corkwood (*Duboisia* spp.) plantations established on the North Coast.

Trial areas of kenaf were sown by farmers in the Moree and Berrigan districts. A paper pulp can be made from kenaf but as yet there does not seem to be a market in N.S.W.

Farmers have continued to show interest in sesame production although only one crop is known to have been grown in N.S.W. in 1971-2. A number of varieties were sown for increase and evaluation on Research Stations.

VEGETABLES

Asparagus

Processing companies play a dominant role in the asparagus industry. The crop is grown under irrigation at Gundagai, Cowra, Bathurst, Mudgee, and Dubbo. Almost all the asparagus produced is canned. N.S.W. is the major producing State of the Commonwealth.

The season was a particularly good one for asparagus, most growers reporting very high yields. The area increased by 10 to 15 per cent over the 3,766 acres grown in 1970-1.

An attempt is being made to establish a large scale asparagus growing venture on coastal sands to the east of Kempsey. The project has encountered nutritional and disease problems.

Beans

The total area for green beans (market and processing) was little different from the 1970-1 figure of 5,633 acres. Production of string beans for the fresh market is declining while the area devoted to green beans for processing is increasing.

The main development in the industry has been the attempt to re-establish field beans on the New England Tableland and the substantial interest in this crop shown by farmers in central western irrigation areas. Of about 2,000 acres of edible dry beans grown in these parts of the State, most were field beans. Unfortunately the summer was both too wet and too cool for best results.

Market prices reflected a fairly normal supply. Prices for dry beans were generally contract-based and were similar to those of the previous season. The industry has been unable to satisfy the domestic demand for dry beans, yet one organization is planning on production for export. This suggests good scope for expansion of the dry bean industry.

The value of varieties of green beans resistant to the disease known as Summer death (virus or mycoplasma) was again evident. However, with the increased use of new varieties of the Tendercrop-type crop establishment problems are occurring more frequently. Common blight (*Xanthomonas phaseoli*) was widespread in many crops of dry beans, being absent only in crops grown at Narromine from seed imported from Idaho. Rust (*Uromyces appendiculatus*) severely affected some varieties in the moister Tableland areas but caused no losses in drier areas further inland.

Cole Crops

Cabbage and cauliflower production was similar to that of last year when 3,347 acres were grown. Production of brussels sprouts and broccoli was generally insufficient to meet demand, although broccoli production increased in central western districts.

There has been a gradual increase in direct seeding and chemical weed control. A few growers at Bathurst and in the Hawkesbury Valley successfully consigned trimmed cauliflowers to the Sydney markets in cartons as opposed to the traditional full leaf bulk method of marketing. It is expected that carton-marketing will continue and that most of the wrapper leaves will be removed on the farm. These two practices will effect economies in handling.

Black rot (*Xanthomonas campestris*), black leg (*Leptosphaeria maculans*), and cabbage black ring spot were widespread in the Maitland area in autumn. *Alternaria* curd spot (*Alternaria brassicola*) caused severe losses in cauliflower crops in the Maitland and Bathurst areas in May and June.

Lettuce

The area devoted to this crop was similar to that of the previous year when 1,756 acres were grown.

There was greater use of fibreboard cartons for marketing and some attempts to grow the crop in newer districts such as the Macquarie Valley. The County of Cumberland and associated areas are still the major suppliers of lettuce to the metropolitan markets.

Seed production for export was again undertaken by a few growers operating under contract in the Murrumbidgee Irrigation Area.

Onions

The areas sown to onions increased by about 20 per cent over the previous year when 2,047 acres were grown. Production continued to be centred mainly in the Murrumbidgee Irrigation Area but interest in onions also continued to increase in other inland areas such as Dubbo, Gunnedah, and Narrabri. Some of the increased acreage, particularly around Griffith, was used for varieties suitable for export to Japan but prices on the home market generally gave the grower a return greater than that received for export onions.

The use of chemicals for weed control continued to expand, while mechanical aids to harvesting were mainly used on crops for the home market.

Rotting caused by various organisms (*Botrytis* sp., *Erwinia carotouora*) was troublesome in onions harvested under unusually damp conditions in the Riverina.

Peas

The area grown under contract was about 5,540 acres compared with 6,327 acres in 1970-1. Imports of frozen and canned peas from the southern States and New Zealand satisfied the major part of the demand.

Potatoes

Potatoes were grown on 25,300 acres which was a 14.5 per cent increase on the 1970-1 area. The proportion of the crop produced in coastal valleys is declining. Seasonal conditions in most districts were favourable, so yields were above average. On the Northern Tablelands the majority of crops yielded from 12 to 20 tons per acre. The combination of increased area and higher yields resulted in an over-supply which caused the lowest prices for several years.

The proportion of the crop devoted to processing again increased, although there was a reduction in the rate of growth of the potato crisp industry. Washing before marketing and pre-packaging increased. Potato-growing is at its lowest economic level for some years because of the increase in farm costs and the low prices received during much of the year. It would appear that prices are tending to stabilize at lower levels because of the increasing proportion of the crop grown under contract to processors at relatively low prices and the release of potatoes from controlled atmosphere storages at strategic times.

The quality of potatoes supplied to the market was mostly satisfactory but green potatoes were more in evidence as a consequence of washing and packing in clear plastic bags.

Rhizoctonia disease (*Rhizoctonia* sp.) is increasing in importance as more tubers are washed and marketed in plastic bags. The disease occurred in many areas of the State but appears to be increasing in severity in the Crookwell, Armidale, and Finley areas. Fusarium dry rot (*Fusarium trichothecioides*) caused significant losses in harvested tubers in Northern Tablelands areas. Two outbreaks of the serious disease bacterial wilt (*Pseudomonas solanacearum*) were recorded in the Ebor-Hernani area. A widespread outbreak of Sclerotinia rot (*Sclerotinia minor*) occurred in the Finley area in autumn causing severe losses in some crops. Late Blight (*Phytophthora infestans*) was prevalent in the Metropolitan area and the Kemspey district in April but fungicide spray programmes gave reasonable control. Powdery scab (*Spongiospora subterranea*) was detected on tubers from three properties in the Ebor area. These properties have been placed under quarantine in so far as seed potato production is concerned.

Tomatoes

It is estimated there was a slight increase in production above the 3,962,873 half-bushel cases produced in 1970-1.

Production of processing tomatoes increased by about 25 per cent, the increase coming from areas in the Macquarie and Lachlan Valleys. In inland districts there is a trend towards larger acreage per grower. Attempts are in progress to develop a tomato harvester which will cost substantially less than imported machines.

Tomatoes for the fresh market continue to be an important crop in the County of Cumberland, the Central Coast, and Far North Coast.

Spotted wilt virus caused widespread losses in spring and summer crops. Crops in the Campbelltown district were badly affected. Big bud (*Mycoplasmata*) was widespread in inland crops, as no economic control is available for this disease.

Miscellaneous Vegetables

The production of other vegetables showed little change from previous years. The only tendency of note was the trend towards the production of specialized lines (e.g., capsicums, garlic, and horse radish) for which there is only a limited demand.

PASTURES

Area

At 31st March, 1971, there were 11,879,000 acres of sown pastures, 2,333,000 acres of lucerne and 3,252,000 acres of topdressed natural pastures in N.S.W.—a total of 17,464,000 acres of improved pastures.

On the other hand, there are approximately 90 million acres of undeveloped native or natural grasslands, 70 million acres of which are located in areas having an average annual rainfall of over 20 inches.

In recent years the area sown to annual pastures has fluctuated up and down with changes in the area sown to crops. However, the area in lucerne and perennial grasses has increased significantly as beef cattle numbers have risen. Lucerne has increased at an average 200,000 acres per year over the past 5 years and has reached a record area of around 2.5 million acres.

Aerial Pasture Improvement

The amount of seed sown from aircraft increased substantially this year but the area topdressed continued to decline as shown below:

			1970-1	1971-2 (estimated)
Area topdressed and/or seeded (acres)	..	..	4,609,000	3,609,000
Superphosphate applied (tons)	..	..	207,890	178,835
Seed sown (lb)	..	..	1,758,000	2,963,000

Pasture Seed Production

Production of certified seed in 1971-2 was only 512 tons compared with 2,338 tons the previous year. This was the result of both a reduction in acreage (because of large carryover seed stocks from 1970-1) and a reduction in yield.

1,100 tons of uncertified seed was processed by seed cleaning firms during the year. Lucerne (331 tons), Wimmera ryegrass (*Lolium rigidum*) (319 tons), carpet grass (*Axonopus affinis*) (181 tons), and paspalum (*Paspalum dilatatum*) (131 tons) were the principal species processed.

Although there has been a continuing reduced demand for seed from a depressed pastoral industry, there was a substantial reduction of carryover seed stocks during the year through export sales.

N.S.W. Herbage Plant Liaison Committee.—This Committee continued to play a significant role in the registration, release, and seed multiplication of new herbage plant cultivars. The Committee during the year recommended the registration of Lespedeza (*Lespedeza striata*) cv. Kaloe, and kikuyu (*Pennisetum clandestinum*) cv. Breakwell, and the release of white clover (*Trifolium repens*) cv. Haifa.

Whittet kikuyu seed.—The Seed Increase Committee achieved a satisfactory distribution of the initial production of 1,500 lb of basic seed of Whittet kikuyu for further seed production.

Pasture Diseases

Root-rot was widespread on subterranean clover on the Southern Tablelands causing reduction in dry matter yields. The damping-off stage of this disease was observed at Goulburn during the autumn. Leaf rust (*Uromyces trifolii repentis*) was very common on white clover in coastal districts and caused scorching and leaf drop. Root knot nematode continued to be a problem in white clover in river flat areas of the North Coast.

Yellows (cause undetermined) was widespread in lucerne stands during the summer. This disease is thought to cause long-term decline of lucerne stands. Stem nematode (*Ditylenchus dipsaci*) was less obvious this year as dry spring conditions were unfavourable for nematode development.

FODDER CONSERVATION

Fodder Reserves

Fodder reserves of hay, silage, and feed grains at 31st March, 1972, were estimated to be sufficient to provide a drought ration for 61 days for all stock in the State. This is about the same as reserves held a year earlier.

The increased numbers of cattle in New South Wales make the adequacy of feed supplies more critical than in the past.

Hay

About 1,300,000 tons of all types of hay (mainly lucerne, pasture, and cereal) were made in the past year. This compares with 1,354,700 tons in 1970-1. Reserves at 31st March, 1972, were estimated at 2,300,000 tons as compared with 2,521,000 tons a year earlier.

Following are estimates for production of the principal types of hay in 1971-2 (production for 1970-1 in brackets):

Type						Production (estimated) (thousand tons)	Price range (per ton) \$
Lucerne	..	..	..	..	..	730 (763)	15-25
Pasture	..	..	..	..	..	Under 400 (410)	10-20
Wheaten	..	..	..	..	..	Under 50 (64)	8-12
Oaten	..	..	..	..	..	90 (114)	8-12

Prices tended to rise above those shown towards the end of the season because of dry weather in most parts of the State.

Silage

It is estimated that stocks of silage held in N.S.W. at 31st March, 1972 exceeded 900,000 tons. This compares with 847,000 tons at 31st March, 1971.

Silage is being made from many types of green crop, pastures, weeds, citrus waste, and plant stubble. Mixtures of two-thirds plant material (usually sorghum) and one-third chicken litter are also finding a place. To a large degree silage is now being utilized for supplementary or production feeding rather than as a drought reserve.

IRRIGATION

Area and Developments

In 1970-1 (the latest year for which figures are available) there were 1,569,551 acres under irrigated production comprising 398,225 acres in irrigation areas, 684,021 acres in irrigation districts, and 486,415 acres watered from licensed diversions (private installations). The largest proportion of the increase of 184,000 acres over the previous year was in licensed diversions.

Pastures occupied 49 per cent of the total irrigated area. The remaining area was sown to cereals, lucerne, coarse grains, oil crops, rice, cotton, horticultural crops, and vegetables.

The decline in wool returns and restriction of wheat production have caused many primary producers to move into other types of production. Land preparation and irrigation management combined with the necessity for new production techniques for a number of oilseed and coarse grain crops have presented a challenge to many primary producers. Expertise of growers in land preparation, irrigation, and husbandry for these crops increased.

On a number of our major streams available water resources have been almost fully committed. The recent completion of Lostock Dam on the Paterson River (16,400 ac ft), Toonumbar Dam on Iron Pot Creek (8,990 ac ft), and Carcoar Dam on the Belabula River (29,530 ac ft), will foster increased development by private diversion. Regulated supplies are still available for irrigation from Pindari Dam on the Severn River (30,350 ac ft) which was completed in January, 1969.

Progress is well-advanced with the Copeton Dam on the Gwydir River which, when the final stage is completed, will store 1.1 million acre feet of water for irrigation of some of the State's richest soils. Research into irrigation requirements of a large range of crops for this area is currently being carried out at Narrabri A.R.S. and in local trials.

Aquatic Weeds

Farmers were concerned with the control of cumbungi (*Typha* spp.) and water couch (*Paspalum paspaloides*) both of which blocked supply channels and drainage ditches on their properties. Control by mechanical and chemical means was necessary.

Stock water supplies were threatened by water hyacinth (*Eichhornia crassipes*) and by salvinia (*Salvinia auriculata*) in coastal districts north of Wollongong.

The extent and density of a large infestation of water hyacinth covering 20,000 acres in the Gingham watercourse west of Moree was surveyed. The infestation has caused concern to interstate authorities as a major flood could lead to the Darling/Murray river system becoming contaminated with this very serious weed.

CITRUS FRUITS

Seasonal Conditions and Production

Temperatures were mild in all citrus districts but rainfall varied considerably from normal. Only 7 inches of rain was recorded in the Murray Valley districts. The M.I.A. had 17 inches of rain but it was erratic in occurrence and there were damaging hail and rain storms in November and February. The mild conditions inland favoured tree growth but adversely affected the quality of maturing crops.

Annual rainfall in coastal districts was average but very uneven in seasonal distribution. Dry conditions resulted in the development of black spot with the maturing Valencia crop and also delayed sizing but good quality fruit brought above-average prices on the market in March/April.

The final estimate of N.S.W. citrus production for 1971-2 was 7,465,000 bushels main crop, plus 200,000 bushels summer crop lemons, and 60,000 bushels second crop Valencias. This was similar to the previous year, with heavy coastal crops offsetting light off-crops inland. The preliminary forecast for 1972-3 suggests a record production in excess of 8 million bushels main crop:

N.S.W. Citrus Production (bushels)

								1971-2	1972-3
								<i>Final</i>	<i>Preliminary</i>
								<i>estimate</i>	<i>forecast</i>
Navels	..	..	..	..	..	..	..	1,870,000	2,175,000
Valencias	..	..	..	..	..	..	..	3,950,000	4,350,000
Commons	..	..	..	..	..	..	..	48,000	41,000
Sevilles	..	..	..	..	..	..	..	11,000	14,000
<i>Total oranges</i>								5,879,000	6,580,000
Lemons (winter crop)	..	..	..	..	..	..	..	900,000	800,000
Mandarins	..	..	..	..	..	..	..	410,000	390,000
Grapefruit	..	..	..	..	..	..	..	276,000	270,000
<i>Total main crop citrus</i>								7,465,000	8,040,000
Lemons (summer crop)	..	..	..	..	..	..	..	200,000	
Valencias (second crop)	..	..	..	..	..	..	..	60,000	
<i>Total production</i>								7,725,000	

Marketing

The local market for citrus was generally depressed with the exception of odd peak demands for grapefruit, summer lemons, large sized mandarins, and late season Valencias. Growers increasingly by-passed the central market. Extensive use of poly-net bags was made on the M.I.A. for supplying citrus direct to supermarket chains, other retailers and consumers. The hawker trade from the M.I.A. and coastal districts also increased in volume.

About 10 per cent of total Australian citrus production was exported with South Australia being the main exporting State. The main markets were Singapore, New Zealand, and Holland. The total of 346,000 bushels of N.S.W. citrus exported through the ports of Sydney and Melbourne, comprised (Australian exported totals in brackets): oranges 318,000 bushels (1,396,000); mandarins 23,000 bushels (152,000); lemons 4,500 bushels (35,000); and grapefruit 600 bushels (5,400).

Export of Ellendale mandarins to U.K., Canada, Singapore, and Belgium expanded rapidly and further development of these markets with this specialty line can be expected provided that better care is maintained in fruit selection, packaging, and fungicide treatment. Good results with lemon exports to the U.K. last year generated further development of this export market.

Processing of citrus is gaining in popularity, as returns have been more reliable and costs are lower. There has been a trend for processing factories to be established inland partly because F.I.S.C.C. price differentials result in inland fruit being \$10 per ton cheaper. One processor at Leeton has opened a second factory at Griffith and now has the capacity to process 1 million bushels of citrus annually on the M.I.A. Whilst the expansion in Australia's domestic consumption of citrus has been solely in processed products, two mild summers have reduced sales and most factories imposed quotas as stocks became excessive. Some export sales were made to the Near East but Australia's high price structure generally makes processed products uncompetitive on world markets.

Industry Organization

The more competitive market situation has reawakened interest in statutory marketing boards for citrus. Polls of citrus growers in N.S.W. will be held to determine whether to: extend the Shire of Wentworth Orange Marketing Board to cater for all citrus areas along the N.S.W. Murray River; and extend the Central Coast Citrus Marketing Board to cover the remainder of the State.

These polls will exclude lemongrowers and the Lemon Marketing Board will remain in existence. Concurrently, the Australian Citrus Growers' Federation has moved to establish an Australian Citrus Board with objectives of national and export promotion and to assist in the regulation of interstate supplies to certain markets.

Industry Developments

An estimated 60 per cent of navel orangegrowers on the Lower Murray used gibberellic acid on the portion of their crop intended either for late, export or local market to maintain a lighter, fresher colour, and delay senescence.

Acceptance by growers of residual herbicides as an alternative to some cultivation practices appears to have been achieved. Usage varies from the control of under-tree weeds to a blanket coverage depending on topography, the district, and individual preference.

Citrus budwood was cut for the first time from the bud multiplication block at the Dareton H.R.S. for the supply of 12,000 grapefruit and 2,000 lemon buds to the N.S.W. Citrus Co-operative Bud Selection Society Ltd. The planting includes thirty commercial citrus varieties and will meet the full needs of N.S.W. nurserymen within a few years, when it will be possible for the Department to introduce a bud certification programme.

Planting Statistics

The N.S.W. fruit tree planting census at December, 1971, shows the overall situation to be stable:

N.S.W. Citrus Planting Statistics

	1970	1971		
	<i>Acres</i>	<i>Acres</i>	(Non-Bearing) %	<i>Trees</i>
Oranges	27,215	27,087	(13)	3,025,217
Lemons	2,972	3,074	(18)	348,994
Mandarins	2,532	2,465	(20)	285,627
Grapefruit	733	795	(34)	93,064
Sevilles and Others	56	57	(21)	6,268
Total Citrus	33,508	33,478	(14)	3,759,170

The trend towards higher planting densities of citrus was confirmed by the census which showed an average of 112 citrus trees per acre (with 134 per acre in the non-bearing group to 7 years old) compared with an average of 100 trees per acre 10 years ago.

Citrus Diseases

The quality of citrus fruits from the Central Coast improved. There was a minimum of rind blemish, and wastage due to green mould (*Penicillium digitatum*) and stem end rot (*Diaporthe citri*). Despite the delayed Valencia harvesting losses due to black spot (*Guignardi citricarpa*) were only slight.

Melanose (*Diaporthe citri*) infections of Washington navel oranges and lemons affected up to as much as 50 per cent of the crop on old trees.

POME FRUITS

Seasonal Conditions and Production

Fruit quality suffered considerably because of blemish due mainly to low temperature, sleet, hail and pests. In the New England district it was estimated that no more than 20 per cent of the apple crop would be of "Fancy" grade and export from the district was prevented. Moderate to severe damage was experienced in all other districts except Campbelltown where the best crop for many years was harvested.

The major significance of the extensive hail damage was reduced income for growers as most hail damaged fruit was channelled into low value processing outlets. Many growers have suffered serious loss of income for 2 years out of the last 3.

Estimated production of apples for 1972 was 4,600,000 bushels which is comparable with the harvested 1971 crop. Only about 50 per cent of the 1972 crop was "Fancy" grade. Consequently a large quantity of fruit has been available for processing, although the demand by processors may not be met fully due to shortages in other States and the increasing consumption of apples in processed forms.

Granny Smith production for this year is estimated to be a record 2,000,000 bushels and future expansion of production of this variety is expected to result in over-supply problems.

The estimated pear crop of a record 950,000 bushels is about 200,000 bushels higher than average. The very heavy Packhams Triumph crop was estimated at 465,000 bushels. Approximately 175,000 bushels of Williams have been canned and the canning fruit industry is faced with a serious over-supply problem.

Export and Local Marketing

Apple exports were seriously reduced by hail and sleet damage, only 46,576 bushels of N.S.W. apples being exported compared with 117,925 the previous year. There was a slight increase in pear exports from 74,548 bushels in 1971 to 99,163 bushels in 1972. This increase was made possible by the admission of Good grade for export. Whereas previously most N.S.W. apple exports have been to the United Kingdom, this year the major portion was shipped to South-East Asia, which also provided the main outlet for N.S.W. pears (as in 1971).

On the local market the trend to selling direct to wholesalers and the public rather than through the Sydney wholesale markets is continuing.

Planting Statistics

At December, 1971, there were 15,414 bearing and 2,601 non-bearing acres of apples and 2,638 bearing and 457 non-bearing acres of pears in N.S.W. Since the previous year, apple acreage had declined by 734 acres and pears by 98 acres, the major reductions occurring in the Campbelltown and New England districts. Should the proposed Tree Pull Assistance Scheme be introduced, further reductions in acreage will occur.

Granny Smith is the major variety with 6,074 acres planted, 12 per cent being non-bearing. Delicious and its red strains is the second most important with 4,750 acres planted (18 per cent non-bearing). However, during the past 3 years, new plantings of the various Red Delicious have greatly exceeded those of Granny Smith, indicating the increasing popularity of the coloured apple. The increase in Delicious is considered to be due to the development of controlled atmosphere storage making a longer marketing period available for this variety. It is also attracting more attention as a variety suitable for export.

Industry Situation

The reduction of 832 acres of pome fruit trees during the past year provides an indication of the present unfavourable economic situation and pessimistic outlook. In N.S.W., bearing acreage has increased appreciably in recent years and in the near future production is expected to increase proportionately more than for Australia, although this will depend on the extent of tree removals. Whilst the majority of N.S.W. apples are sold within the State, it is likely that as the overseas markets deteriorate still further N.S.W. growers will face increasing competition from interstate sources.

Industry Organization

Growers concern at the unfavourable marketing outlook is indicated by interest in the formation of a statutory authority to regulate the marketing of all pome fruits produced in N.S.W. During the year industry meetings, which were held in all districts, without exception authorized the United Farmers and Woolgrowers Association to proceed with further investigations of this proposal.

Industry Developments

A significant proportion of the N.S.W. apple crop can now be stored in controlled atmosphere (CA). During the past year the construction of six CA stores increased capacity by 90,000 bushels to a total of 860,000 bushels. This, together with the pome fruit regular cool storage capacity makes a total N.S.W. cool storage capacity of 3,768,000 bushels. The increase in CA capacity is expected to increase consumer demand for fresh apples during most of the year.

Studies by the Bureau of Agricultural Economics have indicated that over the 4 year period ending 1970, consumption of processed apples in Australia increased by 7 lb per person compared with a total increase in apple consumption of 8 lb. Processing of apples, particularly juice extraction, increased considerably in N.S.W. in the past year.

Recent apple plantings have demonstrated considerable interest in the concept of higher density plantings and the production of semi-dwarf trees.

All pome fruit exported to the United Kingdom and Continent this year have been shipped as containerised cargo and the Scoresby Tray pack carton was adopted as the standard package.

Pests and Disease

Serious damage by dimpling bug (*Campylomma livida*) causing malformation to developing fruits of Delicious and Granny Smith apples occurred throughout the State. This pest is now a problem in districts where previously of little significance.

The prevalence of powdery mildew disease is causing considerable concern and there is thought to be an association between mildew incidence and the lighter pruning techniques which have been developed to induce earlier and heavier cropping.

STRAWBERRIES

The area of strawberries increased further from 106 acres in 1970 to 148 acres in 1971. New plantings have been made in scattered localities through the State and further increases are expected in 1972. Close attention was given to market presentation by most growers and local strawberries regularly realized better prices on the Sydney market than those consigned from other States and New Zealand. Increasing quantities were exported to the Pacific Islands and Near Eastern markets.

The Department introduced a Strawberry Plant Certification Scheme under which sufficient virus-tested runner plants were produced to meet the needs of the industry.

Verticillium Wilt (*Verticillium dahliae*) continued to cause degeneration in many plantings of the variety Torrey in coastal districts. Preplant soil fumigation gave very good control in several plantings which had been infected with *Verticillium* in previous years.

With most growers planting virus free runners, virus diseases have become less important as a cause of degeneration in strawberry plantings.

STONE FRUITS

Seasonal Conditions

Favourable conditions over most of the spring period resulted in satisfactory sets of most stone fruits although prunes and European plums were affected by changeable weather conditions at the end of September. Hail storms caused damage in many scattered locations.

Canning Fruits

The canned deciduous fruit industry is experiencing grave financial difficulties due to the accumulation of large stocks of unsold canned products. The position has been aggravated by changes in currency values which have placed the Australian product at a competitive disadvantage to that from South Africa. The oversupply position in N.S.W. is partly related to increased yields. The 1970-1 yields of apricots and peaches were 7.6 and 8.1 tons per acre respectively, compared with 5.0 and 5.0 average over the previous five years. In the 1971-2 season the Reserve Bank placed limitations on its seasonal advances to canneries for purchase of fruit and most canneries have been forced to place quotas on fruit intake.

The bearing acreages of apricots increased from 1,018 in 1970 to 1,073 in 1971 and of peaches from 3,138 to 3,358. Non-bearing acreages of apricots decreased from 73 to 48 and of peaches from 584 to 461.

Although the 1971-2 apricot and peach crops in the M.I.A. were reduced by hail storms, and brown rot caused further heavy losses in early maturing peach varieties, average yields still exceeded previous averages. The complete apricot crop of 6,500 tons (6.1 tons per acre) was utilized, with a cannery intake of 5,950 tons and 550 tons consigned to the fresh fruit market. Canneries accepted 19,682 tons of peaches and 268 tons were sent to the fresh fruit market, a total utilization of 19,950 tons (5.9 tons per acre). Only small quantities of quality fruit were lost due to cannery quotas but considerable quantities were lost due to high standards required for cannery acceptance and from brown rot and other diseases where growers ceased to apply control measures after being notified of the quota system.

An examination of the marketing situation for canned fruits has revealed no prospects of significantly increasing sales in the near future. The entry of Britain into the European Common Market may well place the Australian industry in an even less favourable position to compete and retain sales outlets in the United Kingdom. With a holding of heavy stocks and a continuing increase in production, it has been necessary to initiate action to equate production with anticipated requirements. To this end, the Canned Deciduous Fruits Industry Advisory Committee, representing Commonwealth and State interests, has recommended the introduction of a Tree Pull Assistance Scheme which is under consideration by the Governments concerned.

Dessert Peaches, and Nectarines

Production is increasing from yellow fleshed early peach varieties introduced from overseas by the Department and released to the industry over recent years. However, there is room for further increases of early varieties which mature before Christmas and for moderate increases of varieties which mature after mid January. The late December and early January markets were fully supplied and only top quality fruit continued to realize satisfactory prices.

Nectarine crops were generally heavy and prices dropped temporarily during the harvesting of main crop varieties from inland areas. Growers are highly interested in recently introduced yellow fleshed varieties which produced a few fruits in trials planted in the main producing areas.

Bearing acres of dessert peaches decreased from 3,763 in 1970 to 3,700 in 1971, while the non-bearing acreage decreased from 606 to 578. There was an increase in the acreage of nectarines; 466 to 471 bearing acres and 148 to 164 non-bearing.

Single layer trays with moulded plastic inserts were again extensively used for marketing dessert peaches and nectarines, with many growers switching entirely to this form of presentation.

Cherries

Average to heavy cherry crops were harvested throughout the State. Quality was generally good but market prices were disappointing during the peak of the season. The crop of sweet red cherries at Orange was estimated at 450,000 quarter-bushel cases and 420 tons of white cherries (84,000 quarter-cases equivalent) were delivered to the brinery. At Young there was a considerable proportion of small fruit in early maturing varieties due to dry spring weather, and losses occurred

from weather damage in late varieties. The total production at Young of 371,000 quarter-cases approximated that of the previous year, and shows an almost complete recovery of production levels since the tree losses in the 1968 drought. Production is expected to significantly increase, over the next few years. Other centres including Armidale, Lakesland, and Griffith, produced moderate crops of good quality from the limited plantings in the districts. Cherry acreage in the State increased from 4,150 in 1970 to 4,584 in 1971. Of the latter, 3,487 acres are bearing and 1,103 non-bearing. Most of the increase has been in the Young district. The Young Cool Stores and Cherry Growers Co-operative expanded its activities into the cherry brining field with the establishment of a brining plant with a capacity of 50 tons of fruit.

Prunes

The 1972 prune crop was comparatively light, due mainly to unfavourable weather conditions for fruit setting during the blossoming period. Growing conditions during the remainder of the season were generally good resulting in fruit of good size. Some fruit splitting and brown rot infections as the fruit matured further reduced crops. The total crop was estimated at a little over 2,000 tons (dried), compared with an average of 3,236 tons over the past five years and a top production of 5,313 tons in 1967. Mechanical harvesters were used more extensively and harvesting and dehydration were completed in a shorter period than usual. Harvesting at Young was completed in less than three weeks. Total acreage of prunes increased from 4,171 in 1970 to 4,204 in 1971 with a decrease of 2 acres in bearing area and an increase of 35 in the non-bearing acreage.

Plums

In coastal districts, Japanese plum crops were variable but good crops of quality fruit were produced inland, particularly at Young. Crops of European varieties were generally light, both on the tablelands and in the irrigation areas. The acreage of plums increased from 2,237 in 1970 to 2,264 in 1971, of which latter 1,682 were of Japanese varieties and 582 of European plums.

Pests and Diseases

Troublesome infestations of stone-fruits by San Jose scale (*Quadraspidiotus perniciosus*) were reported, especially from the M.I.A. where infestation of peach trees was occasionally sufficient to cause some twig die-back.

Infestations of green peach aphid (*Myzus persicae*) were widespread in the M.I.A. where some difficulty in control was experienced. Light to medium infestations of cherry aphid (*Myzus cerasi*) occurred in the Orange district.

Plague thrips (*Thrips imaginis*) caused severe fruit blemish to Narrabeen plums at Young and to nectarines at Young and Bathurst.

Infestation by pear and cherry slug of stone-fruits was very severe in the Young district.

There was a considerable infestation of prunes and cherries by fruit tree moth borer (*Cryptophaga unipunctata*) in the Young district.

Brown rot (*Monilinia fructicola*) of stone-fruit caused less loss in most districts than in previous years but in the M.I.A. it caused severe losses in some individual crops of the early maturing Stanford and Gaume canning peach varieties which had received inadequate spray programmes.

Difficulty was experienced in controlling peach leaf curl (*Taphrina deformans*) in some areas, possibly due to the need to apply sprays at a very specific stage in the growth of the tree.

Rust (*Tranzschelia discolor*) was widespread in stone-fruit in the M.I.A. and caused near defoliation of prunes and European plums at Young. There was evidence that bacterial spot (*Xanthomonas pruni*) was spreading at Bathurst. It caused considerable damage to J. H. Hale peaches at Orange.

Armillaria root-rot (*Armillaria mellea*) was reported last year for the first time on the M.I.A. and eradication procedures were carried out. No further infections have been noted, and it is hoped that eradication has been achieved.

NUTS

Interest has been shown in nutgrowing. A large area of pecan nuts is being planted in the Moree district by an American corporation and an almondgrowing enterprise is being established near Hillston. Numerous enquiries were received about walnutgrowing and information was sought on the growing of pistachio and other nuts.

More than 400 acres, mostly non-bearing, of macadamia nuts have now been planted in N.S.W., due mainly to the continuation of a planting programme by two Sydney-based companies. One company is aiming to have 1,000 acres planted by 1975 and is also inviting investment in an additional 1,000 acres so that advantage can be taken of large scale management techniques and mechanical harvesting.

TROPICAL FRUITS

Bananas

Seasonal conditions.—Abnormally low rainfall in the northern banana growing districts during June–December, 1971, adversely affected plant growth and bunch development and accentuated the effects of pest and disease such as banana weevil borer, nematode damage and Sigatoka leaf spot infections. The southern areas had more normal rainfall. Some areas lost bunched plants through wind and cyclone blow-downs.

Acreage and production.—Acreage dropped from 22,047 in the previous year to 21,806, with a corresponding decrease in the number of commercial growers from 2,208 to 2,156. The decline in acreage occurred in all districts except the Tweed. The total number of packages forwarded to established markets in the various States was 3,379,792, a decrease of almost 163,000 on the previous year. Local sales and direct selling were estimated at 300,000 packages, giving a total production of about 3,700,000. The reduction in production occurred in the northern districts. Production increased in the Coffs Harbour/Nambucca area.

Marketing.—Average prices per bushel (54 lb) were higher than those realized in the previous year, and reached the highest level for several years during the late autumn/winter period. In addition to the lower N.S.W. production, prices were influenced by a drastic reduction in North Queensland production due to cyclone damage. The use of fibreboard cartons increased and 25 per cent of the bananas from all districts except the Richmond were marketed in 30 lb or 35 lb cartons.

Industry developments.—A banana clearance scheme financed by the Banana Growers Federation and the N.S.W. Chamber of Fruit and Vegetable Industries, successfully operated during a trial period when supplies were heavy. Under the scheme, fruit which did not reach a predetermined minimum price was purchased and removed from sale. The growers were paid the predetermined price from the fund.

The Banana Growers Federation further advanced plans to install a banana handling complex at Macksville which will provide covered loading facilities, cooling and storage areas for packed bananas and facilities for fungicide/insecticide treatment of fruit. If successful similar facilities are planned at other major railheads.

The Banana Marketing Control Committee is working towards the upgrading and standardization of ripening rooms and ripening procedures. Amendment of the Banana Industry Act to permit the carrying out of these proposals is being sought.

Diseases.—In the Murwillumbah, Mullumbimby, Lismore, and Macksville areas, the effects of heavy infections of leaf spot (*Mycosphaerella musicola*) and leaf speckle (*Mycosphaerella musae*) in the autumn and early winter of 1971 were evident in the spring of that year. Small bunches were formed and few leaves remained on plants in plantations that did not receive recommended fungicidal control treatments. During the late summer and autumn of 1972 severe spot and speckle developed in untreated plantations at Mullumbimby and Lismore because of favourable weather conditions. Heavy speckle and some spot occurred at Murwillumbah and Macksville. At Coffs Harbour there was a moderate incidence of leaf spot in autumn.

A total of 977 plants infected by bunchy top (Banana Bunchy Top Virus) were detected in plantations in 1971–2 of which 847 were found in the Tweed district.

Avocados

A dry spring/early summer period resulted in heavy fruit shedding. Further drop followed heavy rains in the autumn and some fruit rots developed under these conditions. In addition, water logging occurred where drainage was inadequate, with subsequent tree losses. Monolepta beetle was active and difficult to control under the warm, showery conditions.

During the year more than 70 acres of avocados were planted, bringing the total to 360 acres. A number of small areas were planted amongst or replacing bananas but several larger areas were also established. Production continued to increase and approximately 10,000 single layer fibreboard trays were forwarded to established markets, with a further estimated 5,000 disposed of otherwise.

The good prices realized for the 1971–2 crop have further increased interest in avocado production on the North Coast and on the Murray River under irrigation. On the coast high costs of land and of establishment are tending to lead to development of the industry by investors or under organized rural management groups. One such group plans to plant 400 acres in lots of between 20 and 50 acres in the Richmond district.

Root rot (*Phytophthora cinnamomi*) continues to be the major cause of loss of avocado trees in plantations on the North Coast. Heavy rains in summer encouraged attack by this fungus resulting in widespread death of recently planted trees and trees in young plantations.

Anthracnose (*Colletotrichum gloeosporioides*) was more severe than usual because of the wet conditions.

Passion-fruit

The acreage planted to passion-fruit continued to decline and with a decrease of 100 acres now totals approximately 400 acres. The reductions in area mostly occurred in the Gosford, Parramatta, and Windsor areas, partly due to urbanization, but also due to difficulties in obtaining processing outlets. Fresh fruit market prices continued to be satisfactory and the industry on the North Coast expanded slightly.

Woodiness (passion-fruit woodiness virus) continues to cause rapid decline of plantations in all districts but was particularly severe in the more southerly districts from Gosford to Picton.

Fusarium wilt (*Fusarium oxysporum* f. *passiflorae*) caused the death of many vines in the Gosford and Maroota-Arcadia districts. Use of the resistant rootstock *Passiflora edulis* f. *flavicarpa* had some success, but growers were usually reluctant to purchase grafted plants because the industry is depressed in these districts.

Pineapples

The area of pineapples further declined to 136 acres, because outlets to processors were restricted. Efforts to re-establish a cannery on the north coast have so far been unsuccessful.

GRAPES

Seasonal Conditions

The winter was dry for the second consecutive year. Most districts received variable rain during the critical spring period but the dry spell in the Hunter Valley was not broken until December when all districts received good rain. Heavy rain in January and February resulted in downy mildew and bunch rot development in most districts and heavy losses of Pedro Ximines in the M.I.A. through berry splitting. Otherwise, crop damage was negligible and vintage took place under ideal conditions. Rain impaired the table grape harvest at Campbelltown.

Wine Grapes

Production.—The quantity of wine grapes processed by wineries in N.S.W. was estimated at a record 77,000 tons compared with the light 1971 crop of 52,661 tons and the previous record crop of 70,981 tons in 1970.

A record 60,570 tons were harvested from the Murrumbidgee and Coleambally Irrigation Areas, compared with 38,596 tons in 1971 and the previous record of 53,887 tons in 1970. The big crop can be mainly attributed to an increase in bearing acreage, the average per acre yield of 8.4 tons being slightly less than the 8.9 tons recorded in 1970.

The Hunter Valley vintage was estimated at a record 3,800 tons compared with the 2,484 tons harvested in 1971. A substantial proportion of this crop was harvested from new vineyards and production is expected to expand rapidly as further areas of new plantings come into production.

In the Murray River districts excellent yields of wine grapes were obtained. One grower using a 4 ft wide T trellis obtained yields of 8.5 tons per acre from Cabernet Sauvignon, 20 tons from Muscat Gordo Blanco and 18 tons per acre from Shiraz.

Marketing.—Marketing has been increasingly difficult. M.I.A. growers were obliged to accept reduced prices to ensure acceptance of the whole crop. Although the base prices agreed upon were unaltered from 1971, average prices were reduced in many varieties by the re-introduction of a Baumé scale that provided for a rise or fall of \$3 per ton per degree Baumé variation from the base price Baumés.

Heavy production left a number of Murray River growers without winery outlets. These growers were obliged to sell their fruit on the Sydney and Melbourne markets to home winemakers. Consequently, heavy supplies, particularly of Grenache and Shiraz, saturated this previously lucrative outlet and buyers were highly selective, rejecting poorly coloured lines.

Planting statistics.—In response to rapid increases in domestic consumption of wine, the acreage of wine grapes in N.S.W. has more than doubled from 8,502 acres in 1965 to 18,529 acres in 1971.

Many large new vineyards have been initiated by city investors. Most are located in the Hunter Valley because of its reputation for high quality wine, proximity to Sydney and the relative lack of restriction on vineyard size. Hunter Valley plantings of wine grapes now total 7,135 acres, an increase of 5,811 acres since 1965. It is anticipated that an additional 1,500 acres will be planted in 1972. Most of this area will be in a small number of large plantings.

A large number of small plantings of wine grapes have been made in the M.I.A. Since 1965, plantings in the Murrumbidgee and Coleambally Irrigation Areas have increased from 5,572 acres to 8,555 acres in 1971. Plantings during 1972 are expected to be greatly reduced following the 1972 recommendation of the M.I.A. Wine Grape Planting Advisory Committee that, "no more wine grapes are to be planted except certain premium varieties together with some Muscat Gordo Blanco".

Wine grape planting in Murray River districts and at Mudgee have also increased significantly from 1,116 and 147 acres respectively in 1965 to 1,792 and 648 acres in 1971. Further plantings are expected at Mudgee while plantings in the Murray River districts are expected to remain stable in view of marketing difficulties experienced this season.

Wine consumption and export.—Consumption of wine in Australia steadily increased from 13,845,000 gallons in 1964–5 to 24,385,000 gallons in 1969–70, with an increase in per capita consumption from 1.25 to 1.95 gallons. Following the imposition of the 50 cent per gallon excise in August, 1970, sales of wine increased only slightly to 24,441,000 gallons and per capita consumption decreased to 1.92 gallons. There are indications of a resumption in 1971–2 of the strong upward trend in Australian wine consumption. The halving of the excise in May, 1972 and aggressive marketing by large public companies is expected to further stimulate consumption in Australia. The export of Australian wine has declined, as a result of reduced sales to the United Kingdom, from 1,998,350 gallons in 1964–5 to 1,441,000 gallons in 1970–1.

Industry situation.—Despite the signs that domestic sales for wine may be again increasing, the Australian production potential from the 28,000 acres of new plantings made since 1968 is so great that there is a strong possibility of an over-production of wine grapes by vintage 1974. General indications are that new vineyard development in N.S.W. is stabilizing and few new developments are expected in the foreseeable future.

To cater for increasing production as the new plantings come into bearing, two new wineries were constructed in the Hunter Valley and one in the M.I.A. and extensions were made to most established wineries. It is anticipated that at least three new wineries will be constructed during the next 12 months.

Dried Vine Fruit

Production.—Dried vine fruit production in 1972 from Murray River districts in N.S.W. is estimated at a record 16,166 tons dried weight, compared with the light crop of 9,031 tons in 1971 and the previous record 14,769 tons harvested in 1970. Fruit quality was high, the majority of sultanas delivered being four crown grade, currants three crown grade and raisins four crown grade. "Blobs" in sultanas caused some problems early in the season. Rain early in February caused splitting in sultanas and growers commenced picking sultanas before normal maturity. This immaturity, which was also a consequence of the heavy crop and cool growing conditions, was reflected in light weight and lack of boldness in early shed receivals. Rack spraying was widely used to apply dip mixture to the fruit and limited areas of sultanas were dried by the trellis drying technique.

The good harvest weather and fruit condition ensured low levels of grit in comparison to 1971, when rain damage resulted in a high pick-up of embedded grit. Growers were given an additional incentive to produce "low grit" fruit by the imposition of charges of up to \$5 per ton for gritty fruit.

Marketing.—Despite the failure of the International Sultana Agreement and earlier price cutting competition on the world market, little difficulty has been experienced in disposing of the 1971 and 1972 sultana crops, although at reduced prices. Whilst 75 per cent of Australia's production is normally sold on the world market, a substantial proportion of the small 1971 crop was sold on the more lucrative home market, but poor quality as a result of rain damage led to low returns. Consequently, sultana producers were paid an advance bounty of \$6 per ton from the Sultana Fund of the Dried Vine Fruits Stabilization Scheme for the 1971 crop based on realizations as at February, 1972. Over 80 per cent of the record Australian 1972 sultana crop of 92,000 tons is already committed for sale but present indications are that a payment from the Stabilization Scheme will again be necessary.

Prices received for the 1971 and 1972 currant and raisin crops have been satisfactory and no payment to or by growers under the Stabilization Scheme seems likely.

Planting statistics.—In view of the difficult marketing situation, only 71 acres of drying varieties were planted in N.S.W. during 1971, giving a total acreage of 9,751. The new plantings are barely sufficient to maintain existing areas.

Industry situation.—Disposal of the Australian dried vine fruit crops of 1971 and 1972 was made relatively easy by the light 1971 crop and extensive frost damage to the 1972 crop in California which normally supplies over one-third of the world's dried vine fruits.

However, in view of a stable domestic market, a shrinking world market, and anticipated increased production, future prospects of disposing of Australia's dried vine fruit crops are not good. Price support, available to growers through the Commonwealth backed 1971-5 Dried Vine Fruits Stabilization Scheme, will only guarantee growers returns to a level somewhat below the average cost of production.

Table Grapes

In the Campbelltown district poor fruit set and heavy rain during January and February reduced the potential table grape harvest by 50 per cent. Commercial quantities of the new Cardinal variety were marketed on January 6th, 3 weeks before the harvest of the Muscat Hamburg, and brought excellent prices. Although M.I.A. wineries continued to receive table grapes at favourable prices, the number of half-bushel cases forwarded by M.I.A. growers to the fresh fruit market increased from 82,875 in 1971 to 110,304 in 1972, although this is still well below the 344,517 cases marketed in 1964. Good crops of table grapes were harvested in the Hunter Valley and central tablelands with only minor pest and disease control problems. Large quantities of sultanas treated with gibberellic acid were marketed as fresh fruit from the Murray River districts together with increasing quantities of Cardinal, Italia, Ribier, and Perlette.

Plantings of table grape varieties are slowly declining, the present acreage in N.S.W. being 2,720. However, production in Australia continues to rise largely through increasing diversion of sultana and Waltham Cross onto the fresh fruit market. Production of table grapes in Australia has risen from 25,000 tons in 1965 to 29,249 tons in 1970. In N.S.W. production has been relatively stable with 8,568 tons produced in 1970.

Consumption of table grapes is expected to rise steadily in line with population increases, but this expanding market will be largely catered for by the diversion of the dual purpose sultana and Waltham Cross varieties. Market demand for quality fruit particularly of the Black Muscat variety is strong, and further small plantings of this variety are being made in the Hunter Valley and Mudgee districts.

Diseases of Grapes

In coastal districts of New South Wales downy mildew (*Plasmopora viticola*) was first detected in early January but was generally well controlled by protective fungicidal spray programmes. In the Hunter Valley areas more than half the vineyards were sprayed by helicopter and fixed wing aircraft with excellent control being obtained. A severe outbreak of downy mildew occurred in all inland grape growing districts in mid-January, made worse by the lack of sufficient protective fungicidal cover on the vines at the time. Concern has been expressed by some growers about the importance of poorly protected vineyards as sources of infection for other vineyards and, in at least one district, growers are attempting to co-ordinate spraying to achieve better control.

Powdery mildew (*Oidium* sp.) continues to be an increasingly important disease in all grapegrowing districts. It appears that the spray programmes of many growers are not adequate to achieve good control of this disease. It is anticipated that it will become a disease of major importance, requiring more careful attention to spray programmes. Control in some cases is hampered by the feeling by some winemakers that residues on the fruit at harvest lead to the production of undesirable reduced sulphur compounds in the wine.

SHEEP AND WOOL

Reduction in Sheep Numbers

Low wool prices caused sheep numbers to decline by 8.6 million or 12.2 per cent during the year, the reduction being brought about by fewer matings and increased slaughterings. The latter were at an all time high and were 11 per cent higher than during the previous year. Death rates were also high because of a poor season and some bad management. The decline in sheep population was basically to allow beef cattle numbers to be increased and other enterprises to be expanded.

Wool

The season was unfavourable for high production and reduced wool cuts per head and lowered lambing percentages were general.

The 1971-2 wool selling series opened with depressed prices averaging approximately 63 cents per kg greasy, similar to the previous year. This low level continued till January, 1972, when the weekly average rose to around 70 cents per kg. Steady rises continued till the close of the series in mid-June with values averaging 96 cents per kg. This was the highest weekly average since February, 1969, and a 50 per cent rise on the average price at the opening sale of the series. The increased prices significantly stimulated interest in sheepraising.

The Commonwealth Deficiency Payment Scheme supported producers to approximately 20 per cent of returns up to January. With the increased auction prices since then no deficiency payments needed to be made. The Australian Wool Commission prevented further price declines at auction through its wool buying activities. During the first half of 1971-2, approximately 1 million bales were accumulated. This stockpile was later reduced to about 50,000 bales.

The Australian Objective Measurement Project investigated the practicability and economics of new systems of sampling, testing and sale by sample under normal commercial conditions. The Australian Wool Commission introduced, although not compulsory, special conditions incorporating objective measurement in the 1972-3 wool clip preparation standards. One company operated throughout the wool selling employing modified classing, sale by sample, bids by sealed tender and streamlined handling methods. Prices were comparable with those at auction. Considerable economies resulted from reduced handling.

The Superfine Wool Growers' Association continued to press for improved marketing for superfine wools. The introduction of the firm floor price for the thirty-six superfine wool types during the first half of the selling season was responsible for a 10 per cent lift in prices according to Wool Commission sources. The association was also responsible for the re-rostering of sales to ensure that no two centres sold in the one week.

Sheep Meat

Prime lamb production was about the same as for 1970-1. Following extensive joinings of British breed rams to Merino ewes during the autumn of 1971, a large increase in production was expected. This did not eventuate because of heavy losses of ewes and poor lambing percentages.

Reports indicate that because of the improved wool situation, there have been fewer ewes joined to British breed rams in 1972 than in 1971. However, joinings are expected to be higher than in 1970. The Dorset Horn and Poll Dorset breeds have been preferred as sires to the Border Leicester.

Important developments regarding the marketing of sheep meats that occurred during the year were as follows:

- Dentition replaced visual assessment in the definition of lamb. To be branded as lamb, sheep must not show any permanent incisors.
- Following requests from producer organizations, the Government agreed to hold a producers poll to decide on the establishment of a statutory sheep meat marketing authority.

- The Legislative Assembly appointed a Select Committee to investigate all aspects of the meat industry in New South Wales, particularly in relation to marketing. The Department was invited to present its views.

Sheep Management

Adoption of the mules operation was found by a survey to have increased from 25 per cent in 1966 to 44 per cent in 1971. The increase in the number of lambs mulesed at marketing has been remarkable. The cost of blowfly control is leading to the breeding of plainer bodied sheep. This is particularly evident in ram selection where the overall emphasis is increasingly on the selection of plainer bodied, easy care type sheep.

There has been a tendency for crutching to be abandoned and for dipping to be restricted to every second year. Producers also looked closely at the economics of treating for worms. Expensive broad spectrum drenches were only used where absolutely necessary, at other times being replaced by cheaper narrow spectrum anthelmintics.

Generally, a policy of little supervision of sheep flocks was adopted. This policy appeared to be sound provided essential practices were not neglected.

Industry Situation

The past year has been one of constant change, price fluctuation and adjustment for the majority of producers. With the recent strengthening of wool prices and improved meat export prospects, the outlook for the next 12 months is greatly improved.

Sheep skins improved markedly in value, partly as a result of higher wool prices but more importantly because of increased demand for products manufactured from sheepskins. These include car seat covers, cot mattresses, hospital appliances and furnishings. This improvement is being reflected in the prices for all classes of sheep, particularly crossbred lambs, as skin value is an important component of overall price.

BEEF

Cattle Numbers and Production

The beef cattle industry in New South Wales continued to expand, although there were indications in some districts that rate of expansion had slowed. All areas of the State reported increased cattle stocking rates and because sheep stocking levels did not decrease proportionately property stocking intensities were at an unusually high level.

Comparative statistics for 1970-1 and 1971-2 in New South Wales are as follows:

		1970-1	1971-2
Numbers (cattle mainly for meat production)	..	5,524,000	6,572,000*
Slaughterings—			
Cattle numbers	.. .. .	1,343,900	1,460,800
Calf numbers	.. .. .	228,800	244,800
Production (Carcass weight, tons)	.. .. .	277,900	299,100
Beef and Veal Exports from Cattle Slaughtered (Shipped weight in tons)	.. .. .	50,478	79,551

* Preliminary estimate.

Values of beef and veal production and exports:

		1970-1	1971-2
		\$	\$
Value of Beef and Veal Production in N.S.W.	..	148,943,000	Not available
Value of Beef and Veal Production in Australia	..	610,146,000	691,000,000
Value of Beef and Veal Exported from N.S.W.	..	43,566,000	59,136,000
Value of Beef and Veal Exported from Australia		302,887,000	389,640,000

Notable features were:

- Increase in cattle numbers of approximately 1,048,000 head, or 18.9 per cent.
- Increase in cattle slaughterings by approximately 8.5 per cent.
- Increase in beef production by approximately 7.6 per cent.
- Strong increase in exports of 29,000 tons or 57.7 per cent over 1971 exports.

Dry winters 1971 and 1972 led to widespread adoption of supplementary or lot feeding for cattle fattening. Non-protein nitrogen supplements were also widely used.

Marketing

Two marketing trends developed. Firstly, an increasing number of cattlemen tended to by-pass saleyards and sell directly to the wholesaler on a dressed weight basis. Secondly, there was a continuation of the trend toward heavyweight and lightweight cattle receiving equivalent prices per lb. This led to a greater increase in yearling production than in vealer production.

Producer dissatisfaction with the auction system of marketing slaughter cattle has been strongly voiced. As a result of the Australian Meat Board enquiry into beef grading, classification and promotion, a beef carcass classification pilot trial was launched as a forerunner to a nation wide trial. In addition, the N.S.W. Parliamentary Select Committee on the Meat Industry has carried out a detailed examination of beef marketing. A retail beef grading trial was conducted at Armidale by Professor Yeates of the University of New England.

These investigations are expected to contribute toward rationalization of production and marketing and it is clear that with Australian beef and veal production valued at \$691,000,000 and Australian exports at \$389,640,000, considerable marketing research is warranted, both locally and overseas.

Cattle weighing scales were used on an increasing number of properties, as well as at saleyards. On properties they were used to guide better breeding, feeding, management, and marketing practices. Some thought is being given to the possible value of publicly selling store cattle by weight. Interest in the impending National Beef Recording Scheme, which incorporates the recording and analysis of various criteria, including weight gain, appeared to be considerable.

DAIRYING

Seasonal Conditions

Dry to very dry conditions prevailed throughout most of the major dairying districts during the winter and early spring months. Good rains were received towards the end of spring and early summer and these continued through to autumn 1972. The flooding which occurred in the Richmond, Tweed, and Hunter rivers in January and February resulted in reduced production in those areas.

The favourable seasonal conditions prevailing from late spring resulted in good pasture and crop growth and overall dairy production was maintained at a satisfactory level.

Production

Milk equivalent production for the State was 258,820,752 gallons, 6.2 per cent below that of 1970-1.

Production figures for the previous five years are as follows:

1966-7	..	..	..	322,995,000 gallons
1967-8	..	..	..	310,056,000 gallons
1968-9	..	..	..	278,930,000 gallons
1969-70	..	..	..	310,876,000 gallons
1970-1	..	..	..	275,878,000 gallons
Average	..	..	..	299,747,000 gallons

Industry Developments

The number of registered dairies in the State continued to decline. There was a drop of approximately 11 per cent from 7,946 at 31st January, 1971, to 7,072 this year.

The withdrawals were fairly evenly spread throughout the State except for the Deniliquin dairying area where a reverse trend was apparent and milk production increased. In the Northern districts, change-over to alternative forms of primary production particularly beef cattle raising, was hastened by the continuing expansion of bulk milk collection which necessitates an initial heavy capital outlay on buildings, equipment, and farm roads.

Although there has been a continuing decline in the number of registrations, reports from all districts except Coff's Harbour indicate that this trend is slowing down. This is attributed to the high Dairy Industry Authority price for milk used for liquid consumption and increased prices being paid for milk for manufacture.

The move towards total bulk milk collection in the main dairying areas of N.S.W. continued during the year. It is now approaching the 100 per cent mark in several districts.

The further extension of the Dairy Industry Authority's control of liquid milk supplies in far northern dairying districts and the allocation of a quota of milk to the metropolitan market is seen by milk producers in these areas as a major breakthrough in milk marketing.

Rationalization of dairy companies is still continuing. Seven factories ceased operations and three of these have amalgamated with another viable factory. Some processing equipment is becoming idle during periods of low production.

Markets

N.S.W. is becoming more reliant on other States for butter, cheese and some other dairy products such as casein and condensed milk.

The Australian market for dairy products is increasing slowly with population growth. There has been an increase in cheese consumption per person from 6·4 lb in 1960-1 to approximately 9·0 lb for 1971-2. Most of this increase has been due to increased demands for expensive imported non-cheddar cheeses. Because of this demand, cheese and speciality products such as yoghurts appear to have some potential for development and promotion.

Increased sales of "spreadable" cooking margarines have been one of the main reasons for the continuing decline in local sales of butter. Present annual consumption of butter is approximately 19 lb per head. There is an increasing demand by sections of the general public for table margarine quotas to be lifted, particularly for margarines that meet the National Health and Medical Research Council recommended standards for polyunsaturated margarine.

The dairying industry is concerned about the increasing quantities of highly refined tallow being used in the manufacture of spreadable cooking margarines sold as a substitute for butter. Production of such margarines has reached approximately 25,000 tons annually.

Butter

Total butter production in N.S.W. was 41,741,729 lb compared with 47,382,996 lb last year, a decline of 11·9 per cent. Butter oil production was 12,004,500 lb.

The main reason for the decline in butter manufacture has been the increase in the amount of milk required for liquid consumption and the drop in total production. This trend is expected to continue.

Cheese

The quantity of cheese manufactured in N.S.W. during the year was: Cheddar 11,219,236 lb; processed 3,498,120 lb; cottage 1,834,016 lb; and non-Cheddar varieties other than cottage 2,843,577 lb.

Cheddar represented 70 per cent of all natural cheese made but total manufacture decreased by 1·1 million lb from the previous year. Conversely non-Cheddar varieties other than cottage reached a new peak of 2,843,577 lb, an increase of 62 per cent over 1971-2.

Cottage cheese retained its popularity on the metropolitan markets and total annual output increased by 8 per cent.

Cheese was imported from eighteen countries. Total imports were slightly reduced from 4·8 million lb to 4·56 million lb. New Zealand Cheddar was the main cheese imported with shipments exceeding 1 million lb.

Condensory Products

Manufacture of condensory products was: whole milk powder 16,543,755 lb; skim milk powder 19,839,458 lb; buttermilk powder 1,090,880 lb; buttermilk and skim powder 720,552 lb; stock foods powder 2,912,567 lb; infant foods powder 4,749,629 lb; malted milks powder 20,134,212 lb; and condensed milks 2,004,108 lb.

Factory production of milk powders and condensed milk, due to the buoyant overseas market, was higher than the previous year with marked increases in output of whole milk and skim milk powders.

Prices on the domestic, local and export markets affected production of stock foods powder which dropped to 2·9 million lb compared with 8·8 million lb in 1970-1.

Other Dairy Products

The production of other dairy products was: yoghurt, cultured buttermilk, and sour cream 18,324,840 gallons; cream mix 99,986 gallons; and ice cream and frozen products, an estimated 16,400,000 gallons.

The demand for these products continues to increase.

PIGS

Production

The pig industry again expanded during 1971-2. Preliminary figures indicate that the State's brood herd could rise from 118,000 in the previous year to 155,000, an increase of 31 per cent. As a consequence, the total number of pigs in N.S.W. is expected to rise from 796,000 to over 1 million.

Despite this increase, pig slaughterings in N.S.W. have shown an estimated decrease of 60,000, due to the movement of pigs for slaughter in Queensland and Victoria. The average dressed weight of pigs slaughtered remained constant at approximately 101 lb, indicating that the proportion of pigs sold as porkers and baconers did not appreciably alter.

Production of bacon and ham again showed an increase, being approximately 12 per cent higher than in 1970-1.

Marketing

Prices during the first four months continued on a level equal to those of the previous year. During November a downward trend commenced and resulted in an average fall of 7 cents per lb for both porkers and baconers. Top prices paid for quality pigs were generally considered satisfactory but prices for lower quality would often be below the cost of production.

With the increased numbers of pigs available, buyers were able to be more selective and a wide range in prices existed between good and bad quality. In many areas there has been a trend away from saleyard auctions to sale on a weight and grade basis. Marketing groups have developed with a resultant appreciable price advantage to members.

Domestic consumption increased because of the population rise and the substitution of pigmeats for beef and mutton in diets. Consumption per capita is estimated at 15.3 lb for pork and 10.2 lb for bacon.

As less than 2 per cent (2,500 tons) of Australia's total pigmeat production was estimated to be exported during the year, the increase in production was absorbed by the local market. No increase in exports is anticipated in the near future. A small amount of pigmeat, mainly in a processed form, was imported.

POULTRY

Egg Production

The egg industry remained in a depressed condition because of high production in excess of local demand. Total New South Wales production rose by 0.6 per cent above the record level of 88.0 million dozen eggs for 1970-1. Export prices for eggs were very low. The major outlet was Japan but prospects for continued export are poor. Stocks of frozen egg pulp have increased dramatically and pose a high storage cost problem with no prospect for profitable future sales.

The Central Egg Marketing Authority (CEMA) hen levy was maintained at its maximum of \$1.00 per bird during the year. Despite this level, the N.S.W. Egg Marketing Board has applied an additional levy of 0.5 cent per dozen from April to supplement reimbursement from the CEMA funds for equalization of returns from export and local sales.

The total layer flock was maintained at a higher level than in 1969-70, despite poor returns and a smaller number of farms. Many producers maintained a higher flock size in anticipation of quotas being issued under egg industry stabilization legislation.

The Egg Industry Stabilization Act provides for issue of licences and quotas to limit flock size, to equate supply of eggs with local demand and for the formation of a licensing committee to issue and administer licences. Establishment of this committee is dependent on results of a poll of producers.

Poultry Meat

Chicken meat production was similar to the previous year. Early in 1971-2, surplus stocks of frozen chickens caused problems. However, due to the integrated structure of this section of the poultry industry, voluntary control was more readily applicable and allowed more effective programming of production. In the latter half of the year, chicken hatchings were generally lower than the same period last year. Total production for the year is estimated at approximately 50 million chickens. More chicken meat was sold in processed form while a change of emphasis from frozen to fresh chicken occurred.

Use of controlled environment housing continued to increase, particularly in integrated companies which commenced their own growing operations. There is strong pressure on growers with open type housing to insulate the roof to conserve heat during brooding and to reduce radiant heat in summer.

Approximately 1.2 million turkey poults were hatched—slightly greater than the 1.1 million hatched during 1970-1. A takeover of one of the major breeding and producing organizations consolidated turkey production into two major companies.

Duck production showed a substantial increase to approximately 900,000 ducks compared to 700,000 during 1970-1. The major integrated poultry organizations within the industry were responsible for this increase.

HONEY

Mechanization of most operations continued to increase because of the difficulty in obtaining suitable labour. This has led to a significant increase in the number of colonies operated by most full-time beekeepers. Improved technology, including the use of repellents and special devices for separating honey from brood areas also reduced manual labour. More beekeepers built central extracting plants to replace the mobile units which, formerly, were almost universally used.

A world shortage of honey and poor seasonal production in most of the important honey producing centres in both this State and Australia generally resulted in a rare situation where the demand for honey greatly exceeds the supply. Honey prices almost doubled during the year. New South Wales normally produces 40 per cent of the Australian honey crop, of which 30 to 40 per cent is exported, mainly to Europe. This year premium lines of honey were exported to new markets particularly in the U.S.A. which is the largest honey producing country in the world.

PEST INCIDENCE—GENERAL

Pest incidence specific to a particular industry has already been covered above. This section deals with pest incidence which has been of a more general nature or which for other reasons is more conveniently dealt with separately.

Pasture and Field Crop Pests

The Australian plague locust (*Chortoicetes terminifera*) was very active in the southwest and Far West during the year and caused widespread damage to native pastures but the damage was of only restricted economic significance. An intensive control campaign was organized by officers of the Department with the result that damage to the intensive agriculture of the M.I.A. and other irrigation areas was reduced to an insignificant level.

Dry conditions during autumn and winter did not favour the red-legged earth mite (*Halotydeus destructor*) or blue oat mite (*Penthaleus major*) and few reports of damage to winter crops or pastures were received.

Outbreaks of cutworm, particularly the brown cutworm (*Agrotis munda*) occurred in many parts of the State during spring and early summer. Newly sown sunflower, grain sorghum, maize, millet, and lucerne crops were affected and in some cases replanting was necessary.

Budworm caterpillars (*Heliothis* spp.) damaged the tassels and cobs of maize and sweet corn crops in the central and southwest during late summer, causing significant losses in some instances. The fruiting parts of lucerne, linseed, field pea, lupin, sunflower, and rapeseed crops in the south, central, and northwest were also attacked and estimates of damage ranged from slight to moderate.

The green vegetable bug (*Nezara viridula*) was active in the north and northwest in summer and autumn and in the central west during autumn. Maize, sunflower, soybean, and wheat crops were affected and suffered variable damage.

Caterpillars of the lucerne seed web moth (*Etiella behrii*) bored into the developing pods of soybean, lupin, and field pea crops in the south, central, and northwest during spring and autumn and caused a slight reduction in seed yield.

Large numbers of nymphal and adult stages of a black thrips (*Haplothrips* sp.) infested sunflower and grain sorghum inflorescences and maize cobs in the south, central, and northwest during summer, but caused no apparent injury.

Vegetable Pests

Dry conditions in October favoured cabbage moth (*Plutella maculipennis*) in the County of Cumberland. High populations of cabbage white butterfly (*Pieris rapae*) were present in the Bathurst and Hawkesbury districts in the autumn.

Seedling maggot (*Hylemya* spp.) damaged the curd of cauliflower in the Bathurst district in the late autumn.

There was an upsurge in populations of green vegetable bug (*Nezara viridula*) in the summer and autumn in central western districts. Asparagus, bean, and tomato crops were attacked.

Heliothis caterpillars were prevalent in tomato crops on the North Coast in the spring and in the western districts in late summer.

Pests such as onion thrips (*Thrips tabaci*) in the M.I.A. and Hunter district, 28-spotted ladybird (*Henosepilachna vigintioctopunctata*) and pumpkin beetle (*Aulacophora hilaris*) in the M.I.A., bean fly (*Melonagromyza phaseoli*) and bean blossom thrips (*Taeniothrips nigricornis*) on the North Coast required control measures.

Queensland Fruit Fly

The occurrence of Queensland fruit fly (*Strumeta tryoni*) in western areas was favoured by humid conditions in the early summer, following the previous year of heavy rain in summer in northwestern districts.

Infestation was found in home gardens at Broken Hill late in December and, in the southwest of the State, infestation occurred in areas normally free of fruit fly, including Narrandera and Leeton. Elsewhere in coastal and tableland areas infestation was on more normal levels.

Stored Product Pests

Lesser grain borer (*Rhyzopertha dominica*) was the major pest in bulk wheat storages. This pest was often accompanied by rice weevil (*Sitophilus oryzae*) and rust red flour beetle (*Tribolium castaneum*). Flat grain beetle, (*Cryptolestes* sp.) was unusually prevalent in bulk wheat storages, presumably because unfavourable harvesting conditions led to storage of grain out-of-condition. Both rice weevil (*S. oryzae*) and granary weevil (*S. granarius*) commonly infested wheat, oats and barley stored on farms and at railway sidings. Saw-toothed grain beetle (*Oryzaephilus surinamensis*) also occurred in farm-stored grain. Hairy fungus beetle (*Typhaea stercorea*) often of concern in late deliveries to bulk storages, was associated with damp grain in temporary storage bins and in harvesting equipment on farms. Confused flour beetle (*Tribolium confusum*) was taken from flour mills and stock feed at Sydney.

Domestic Pests

No argentine ant infestations are now known to exist in the State. Further encouragement to the view that this pest will be successfully eradicated from Sydney and Wollongong is given by the lack of new infestations during the year.

2. ADMINISTRATION

CENTRAL ADMINISTRATION

Central Administration embodies the Executive and branches providing centralized administrative services for the Department. The main functions of the branches are:

Central Secretariat

Provides secretarial and service assistance for the Minister and Executive, keeps central records system and makes submissions on office accommodation.

Staff and Personnel

Inducts and counsels staff, prepares staff submissions, keeps salaries, leave, and other staff records.

Accounts

Receives and pays public moneys, keeps financial records, controls purchases, and inspects accounts of branches and institutions.

Legal

Drafts legislation, conducts prosecutions, gives legal advisings, and makes registrations.

Automatic Data Processing

Investigates, advises, and conducts computer programmes and associated work.

Organization and Methods

Surveys, investigates, and reports on improved work methods.

Others within the definition of Central Administration are the executive assistant to the Senior Deputy Director-General; the principal officer (pest destroyers); the training officer and the safety officer.

Separate reports are given in this section of the more important activities during the year of the Central Administration components.

ACCOUNTS

Departmental

The day-to-day running costs of the Department of Agriculture are met from Consolidated Revenue Fund. Receipts in respect of the administration of various Acts of Parliament, as well as contributions from the Commonwealth towards certain specified functions, are paid into Consolidated Revenue. Expenditure by the Department from this Fund totalled \$23,797,174 while revenue amounted to \$5,161,347.

The expenditure of \$23,797,174 financed such functions as:

- cattle tick control (\$4,749,340);
- upkeep of the Royal Botanic Gardens and Centennial Park (\$819,974);
- maintenance of the Department's seventeen Research Stations (\$2,087,488); and,
- five Agricultural Colleges (\$3,344,712).

Extension and Applied Research

Apart from finance from Consolidated Revenue, the Commonwealth provides a special grant known as the Commonwealth Extension Services Grant. Expenditure from this grant amounted to \$1,346,467 during 1971-2 and was devoted entirely to extension and applied research. A comparative itemized statement of this expenditure is included in Appendix I of this report.

Other Research Finance

Funds provided by industries, semi-government bodies, and special Commonwealth grants are utilized in a considerable number of research programmes and projects conducted by the Department. Expenditure from these sources in 1971-2 amounted to \$991,676 and to this figure would have to be added an estimated amount of \$540,000 as the research component of Commonwealth Extension Services Grant. Details of the calculated figures are shown in the following statement:

<i>Fund</i>						1969-70	1970-1	1971-2
						\$	\$	\$
Industry/Commonwealth Grant—	Extension	Services						
Special Research Fund	..	..	..	..	..	43,600	14,900	15,400
Wheat Industry Research Committee of New South Wales	..	..	..	..	..	155,315	138,604	115,560
Wheat Industry Research Council	..	..				71,607	52,066	57,320
Wheat Industry Stabilization Fund	..	..				4,500	..	..
Australian Meat Research Committee ..					..	140,187	166,996	208,045
Wool Research Trust Fund	..	..	..			274,550	388,097	384,433
Australian Wool Board Post-Graduate Scholarships	..	..	..	..	..	19,200	19,683	20,686
Australian Dairy Produce Board					..	63,557	80,156	70,605
Banana Research Advisory Committee ..					..	9,250	10,605	4,125
Tobacco Industry Trust Account					..	54,520	55,695	63,532
Rural Credits Development Fund					..	..	10,000	39,000
Council of Egg Marketing Authorities of Australia	..	..	..	..	..	12,710	2,250	1,050
Australian Chicken Meat Research Committee ..					..	..	5,750	9,870
Dried Fruits Research Committee					..	..	..	2,050
<i>Totals</i>	..	..	..	..	..	\$848,996	\$944,802	\$991,676

Capital Works Programme

Funds for various capital works programmes are provided from General Loan Account and Commonwealth grants under the Advanced Education and Technical Training Acts. General Loan is financed entirely by the State of New South Wales, while Advanced Education is financed \$1 for \$1 by the State and Commonwealth and the Technical Training is wholly financed by the Commonwealth. Expenditure on capital works during 1971-2 amounted to \$2,284,852, made up of \$700,000 from General Loan, \$1,476,824 from Advanced Education, and \$108,028 from Technical Training funds.

Details of the Department of Agriculture's financial operation under Consolidated Revenue Fund, General Loan Fund, and various Special Deposits Accounts appears as Appendix I to this report.

Accounts Branch—Improvement in Methods

During 1971-2 a system of accounts coding was introduced to facilitate the correct appropriation of charges to the various Consolidated Revenue Fund, General Loan and Special Deposits Accounts. This system has been extended to cover all requisitions placed on Government Stores Department for materials held in stock there. It is hoped to eventually handle the payment of all Government Stores Department invoices by having the computer summarize all requisitions on a monthly basis and making payment by means of a Treasury transfer.

An organization and methods survey of the Branch, which concluded in 1971, resulted in several improvements to work methods being adopted.

OFFICE ACCOMMODATION

Action continued throughout the year with the Public Service Board and the Government Real Estate Section of the Housing Commission of N.S.W., to improve country office accommodation. Successful negotiations were undertaken to renew expiring leases.

Centres throughout the State where either new accommodation was obtained or existing accommodation was improved are:

Armidale.—Improved ventilation and sun louvres installed.

Parramatta.—Extension approved to accommodate Department of Agriculture staff in Forestry office.

Bourke.—Office constructed in Pastures Protection Board premises to accommodate Border Inspector.

Cooma.—Additional space secured and renovations made.

Glebe Island.—Modern accommodation provided by Grain Elevators Board of N.S.W. for Inspectors (Plant Diseases Act).

Griffith.—Greatly improved accommodation leased.

Kempsey.—Additional accommodation obtained for district and Tick staff.

Kyogle.—Negotiations concluded for new accommodation to be occupied early in 1972-3.

Macksville.—Renovations carried out to existing accommodation.

Moree.—A new Government office building under construction and expected to be ready for occupancy early in 1973.

Orange.—Substantial additional office space obtained for district and College staff.

Parramatta.—Soil Survey Unit transferred from Biological and Chemical Research Institute, Rydalmere to new premises in Parramatta. Accommodation also found for the Principal Officer (Pest Destroyers) as a temporary measure.

Scone.—Accommodation obtained in the Pastures Protection Board office for agronomy staff previously located at Muswellbrook.

Singleton.—New district office established and accommodated.

Wagga.—Improved storage space arranged in the Government building.

Wentworth.—Accommodation was obtained for a veterinary officer now stationed at Wentworth.

Windsor.—Recommendations have been made for substantial repairs and renovations to accommodation leased from Windsor Municipal Council.

COMMITTEES, COUNCILS, AND TRUSTS

The Department was represented at meetings of the Australian Agricultural Council held during the year in Canberra and Perth. Both meetings were preceded by sessions of the Standing Committee on Agriculture.

Farrer Memorial Trust

Donations to the Farrer Memorial Research Scholarship Fund were received from the Wheat Industry Research Committee of New South Wales (\$2,000) and the Rural Bank of New South Wales (\$100), making a balance of \$22,647.75 as at 31st December, 1971. Total funds held by the Trust at that date amounted to \$37,406.71, comprising investments in authorized securities of \$35,120.00 and \$2,286.71 cash at bank.

Ministerial approval was granted for action to proceed for amendment of section 6 of the Farrer Memorial Research Scholarship Fund Act, 1930, to permit interest derived from invested capital to be used not only for scholarship purposes but also for expenses incurred in connection with the annual Farrer Memorial Oration. Action had not been completed by the close of the period.

The 1971 Farrer Memorial Medal was presented to Mr Eric E. Bond, Director of the Bread Research Institute of Australia at a ceremony organized in conjunction with the New South Wales Branch of the Australian Institute of Agricultural Science, held in the Great Hall, University of Sydney on 15th September, 1971—The Oration delivered by Mr Bond under the title "Wheat Quality—Yesterday, Today and Tomorrow", was well-received by those present.

An overall review of the scholarship terms and conditions was completed and applications were invited for the award. Following upon consideration of the twenty-one (21) applications received, the 1972 Farrer Memorial Scholarship was offered to, and accepted by, Mr R. A. Hare of Normanhurst, New South Wales. The scholar's research is being undertaken at the University of Sydney into "Non-specific Disease Resistance to Stem Rust in Wheat".

Professor J. M. Vincent, Head of the School of Microbiology at the University of New South Wales accepted the invitation of Trustees to be the 1972 Farrer Memorial Medallist and arrangements were put in hand for a presentation ceremony to be held later in 1972.

There were several changes in membership of the Trust during the year, as detailed hereunder:

Official trustees.—Mr B. Doman retired as Principal, Hawkesbury Agricultural College and his position on the Trust was taken over by Dr F. G. Swain, the incoming Principal.

Professor K. O. Campbell completed his term as Dean of the Faculty of Agriculture, University of Sydney and he was replaced on the Trust by Mr L. N. Balaam, who took over as Dean.

Non-official trustees.—Mr M. Heath resigned from the Trust for personal reasons and at the close of the year action had not been completed for appointment of his successor.

Royal Botanic Gardens and Government Domain Trust

Trustees met on two occasions to discuss matters of policy affecting the parklands under their control.

Some public controversy followed the passing of the Sydney Opera House (Amendment) Act, authorizing the construction of a car park in the Inner Domain-Royal Botanic Gardens at the northern end of Macquarie Street. Objections raised by Trustees to the proposal were overruled.

Other important matters considered included:

- a proposal for the establishment of a Japanese garden;
- the formation and proposed activities of the Botanic Gardens Society;
- an outline of future policy for the Royal Botanic Gardens;
- a proposed horticulture centre for Sydney;
- a dispute concerning the siting of ventilators in the Government Domain to service the Eastern Suburbs Railways project;
- the use of the Government Domain for parking motor vehicles during public transport stoppages.

Dr J. S. Beard relinquished his position of Trustee following upon his resignation towards the end of the year as Director and Chief Botanist. Appropriate action was commenced for appointment of his successor, Dr L. A. S. Johnson, as a Trustee.

MARKETING BOARDS AND POLLS

The Division of Marketing and Economics is responsible for the administration of the Marketing of Primary Products Act, and in particular for the conduct of polls arising from that Act.

The *Egg, Lemon, Rice, Tobacco Leaf, Wine Grapes, and Central Coast (N.S.W.) Citrus Marketing Boards*, constituted under the Marketing of Primary Products Act, continued to operate and fulfil their statutory obligations.

The *Grain Sorghum Marketing Board* commenced operations during the year, having been formally constituted in June, 1971.

The *Citrus Fruits (Excluding Lemons) Marketing Board* for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila, constituted in 1966, showed little activity.

In addition a *Barley Marketing Board* was constituted on 21st January, 1972, and an *Oats Marketing Board* was constituted on 24th March, 1972. Neither of these boards has commenced operations but it is anticipated they will market the 1972 harvests for which they are responsible.

During the past 12 months a number of regulations concerning the above Boards were amended and new regulations were made for the *Grain Sorghum and Barley Marketing Boards*.

Polls under the Marketing of Primary Products Act

Eight polls were conducted during the year under this Act. These were:

1. Triennial election of three producers representatives to the *Tobacco Leaf Marketing Board* for the State of New South Wales (9th July, 1971).
2. Poll on the question of the constitution of a *Barley Marketing Board* for the State of New South Wales (7th August, 1971).

3. Poll on the question of the constitution of an *Oats Marketing Board* for the State of New South Wales (6th October, 1971).
4. Triennial election of five producers representatives to the *Wine Grapes Marketing Board* for the Shires of Leeton, Wade, and Carrathool (10th December, 1971).
5. Election of five producers representatives to the *Barley Marketing Board* for the State of New South Wales (10th December, 1971).
6. By-election of one producers representative to the *Tobacco Leaf Marketing Board* for the State of New South Wales *vice* Mr R. N. Southam, deceased (4th February, 1972).
7. Election of three producers representatives to the *Oats Marketing Board* for the State of New South Wales (1st March, 1972).
8. Triennial election of five producers representatives to the *Lemon Marketing Board* for the State of New South Wales (28th April, 1972).

In addition to the abovementioned polls preparations have been made for taking of the following polls:

1. Poll on 28th July, 1972, on the question of the constitution of an *Oilseeds Marketing Board* for the State of New South Wales.
2. Poll on the question whether an additional area should be incorporated in the area controlled by the *Central Coast (N.S.W.) Citrus Marketing Board*.
3. Poll on the question whether an additional area should be incorporated in the area controlled by the *Citrus Fruits (excluding Lemons) Marketing Board* for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila.

Both the last-mentioned polls are set down for 27th September, 1972.

Well advanced are preparations for taking of a poll on the question of the constitution of a *Sheepmeats Marketing Board* for the State of New South Wales and of a *Seed Cotton Marketing Board* for the State of New South Wales. No date has been set for taking of the latter poll but the former is scheduled tentatively for 15th November, 1972.

The Electoral Commissioner of New South Wales conducted the two polls for the establishment of an *Oats Marketing Board* for the State of New South Wales and is also conducting the poll on the question of the constitution of a *Sheepmeats Marketing Board* for the State of New South Wales.

Other Polls

The Division is conducting a poll under the Egg Industry Stabilization Act, 1971, on the question whether a Licensing Committee shall be established to control the production of eggs in New South Wales. This poll is scheduled for 11th August, 1972.

The Division has been asked to conduct a poll for the election of six State Councillors to the *Potato Growers Association* of New South Wales. The taking of this poll has been scheduled for 25th October, 1972.

A request has also been received from the *Dried Fruits Board of N.S.W.* to conduct a poll for election of four producers representatives to that Board. The poll must be conducted early in February, 1973.

LEGAL BRANCH

Acts

The Branch was involved in the work leading to passage of the following Acts of Parliament:

- Wheat Quotas Act, 1971.
- Egg Industry Stabilization Act, 1971.
- Plant Diseases (Amendment) Act, 1971.
- Meat Industry (Amendment) Act, 1972.
- Meat Industry Authority (Amendment) Act, 1972.

Regulations, Proclamations, and Notifications

During the year work leading to the gazettal of forty-six regulations, eighty-four proclamations, and sixty-eight notifications was undertaken.

Loans

Twenty-one Executive Council Minutes were prepared in respect of loans proposed on behalf of the Grain Elevators Board and Sydney Farm Produce Market Authority.

Arbitration under the Agricultural Holdings Act, 1941

During the year five matters were referred to arbitration and two of these have been heard by an Agricultural Committee.

Prosecutions

One hundred and twenty-four informations were prepared for prosecutions for offences under the various Acts administered by the Department.

Registrations

Registration effected during 1970-1 and 1971-2 are compared numerically hereunder:

						1970-1	1971-2
Farm Produce Agents	..	..	..	..	..	254	272
Veterinary Surgeons	..	..	..	..	..	884	937

The Board of Veterinary Surgeons of New South Wales met on fourteen occasions during the year. Included in this are two extraordinary meetings when the Board met to hear a complain against a registered veterinary surgeon in terms of section 18A of the Veterinary Surgeons Act, 1923.

AUTOMATIC DATA PROCESSING

This section provides a data processing service for Divisions and Branches of the Department. It is responsible for the initial investigations to resolve whether the use of ADP techniques is warranted in connection with an activity or project, and if approved, for designing, developing, and implementing the ADP system for that project. It also provides assistance and advice on computer programmes and programming, data preparation and use of computer facilities generally.

The main activities during the year were in connection with the following projects:

Dairy Herd Recording

This was the first ADP system to be implemented in the Department, in 1963. It provides for recording details of milk and butterfat production and other information for about 100,000 cows under record each year and for assessing the breeding worth of sires whose daughters are recording under the scheme.

Reprogramming of the ADP system for dairy herd recording, necessitated by a change in computer equipment, was completed in December, 1971. This involved the conversion of 180 programmes written in "assembly" language (EASY) to 93 COBOL programmes.

A review of data input devices is being carried out. A pilot trial involving the use of a new data sheet for entering production records that can be read directly by a machine has commenced. The trial will be carried out initially on a small number of herds. If successful, this will eliminate the punching and verifying of 10,000 data cards a month.

The new data sheet has been designed and is being printed. Arrangements have been made with the Department of Railways to develop a programme for reading these data sheets through an optical character reader installed in that Department.

Beef Cattle Performance Recording

Performance records of calves, dams, and sires in eighty beef cattle herds in New South Wales, Queensland, and Tasmania are currently being analyzed under the ADP system developed for this work in 1968.

An Australia-wide scheme, based on the New South Wales system, is to be launched in August, 1972. The national scheme will be operated by the University of New England at Armidale. Arrangements have been made for the performance records of the animals in the eighty herds currently being processed to be transferred to the national scheme and the New South Wales system will be phased out of operation by the end of 1972.

Fruit Tree Census

In this system data relating to the number, acreage, and age of fruit trees, vines, and berries growing in New South Wales are stored on magnetic tape and updated annually.

Calculation of statistics of plantings as at 31st December, 1971, and reporting results was completed in May, 1972. This was the third census to be carried out under the ADP system developed for this work in 1970.

Plant Pathology Herbarium Collection

An ADP system is being developed for recording, indexing, cataloguing, and information retrieval in connection with a collection of over 20,000 specimens of plant diseases maintained in the Biology Branch.

Data relating to about 4,000 specimens have been stored on magnetic tape. Capture of data on the remaining specimens is continuing.

Pesticides

The use of ADP techniques to record, index, and retrieve information in connection with the registration of pest destroyers in New South Wales is being investigated.

File Index

A general indexing programme was used successfully to produce a subject index of files held in the records systems of the Chemistry Branch and the Division of Research Services.

TRAINING

During the past year eight officers were awarded Public Service Board part-time scholarships making a total of forty-two officers who are undertaking part-time studies under these awards. The majority of scholarship holders are agricultural college diplomates who are undertaking the Bachelor of Arts degree by external studies. One officer was successful in gaining one of the two Public Service Board Fellowships awarded.

There was a sharp increase in the number of officers sitting for internal examinations, particularly examinations for inspectors, Plant Diseases Act, and the higher grades examinations for field officers. There were seventy candidates for the latter examination, which is the highest number of officers ever to sit for this examination. All candidates for internal examinations were assisted by being given tutorial material.

Officers attended Public Service Board dictation techniques, orientation, effective reading, and receptionist training courses. Arrangements were also made for officers to attend short courses offered by private organizations and the University of New England's Department of Extension.

The Training Officer (Mr A. H. White) was chairman of the Public Service Training Officers' Group for the year and collated the reports of subcommittees to prepare the report on Training in the Public Service which was forwarded to the Public Service Board.

In 1970 the Public Service Board approved the appointment of a clerk and typist to assist the training officer. However, the lack of funds prevented the approval being effected. A further approach was made to the Board in the 1971-2 financial year but the budgetary situation again prevented approval for the appointments. It is hoped the appointments can be made in the coming year.

SAFETY

The Safety Officer (Mr F. J. Field) continued an active programme of safety education, planning, and inspection. He attended in-service training courses and has now completed full requirements for the conduct of safety education courses. A course on conference leadership he attended was regarded as being of special benefit.

Thirteen courses were conducted by Mr Field at various departmental establishments and this is regarded as a major achievement in the interests of safety. Four meetings were held during the year of the intradepartmental committee, consisting of senior representatives of the Divisions. The committee is responsible for the direction and review of the Department's activities in safety.

At the end of the year matters under investigation were:

- injuries to meat inspectors;
- construction of cattle dips;
- plans for evacuation and fighting of fires;
- accidents to departmental motor vehicles;
- lifting and handling methods;
- appointment of local safety committees.

Final accident figures for 1971-2 are not available but it is known that there has been some reduction over the 1970-1 figures.

ORGANIZATION AND METHODS

During the year reports were submitted on four surveys from which came forty-six major recommendations. The survey of Accounts Branch resulted in introduction of new procedures for payment of vouchers; decoding of departmental accounts; new procedures in preparing monthly statements of expenditure; and a new system for preparing invoices. Recommendations from the survey of the Western Agricultural Region resulted in more adequate provision for accounting requirements and facilitated the local reproduction of necessary pamphlets and extension material.

Recommendations from the survey of the Meat Inspection Service provided improved procedures for issuing invoices and for copying statistics. Survey of an activity within Staff and Personnel Branch produced a new procedure for control and maintenance of staff vacancy records.

The analyst and methods officer assisted with the design of new office layouts for the Moree and Armidale district offices; installation of a new telephone service at the Poultry Research Station, Seven Hills; a new procedure for issuing potato growers licences; an investigation into the present methods of dealing with claims for cattle compensation and enquiries into the methods in use in the official section of the herd recording section of the Division of Dairying.

More than 200 various office aids were acquired during the year for use by officers of the Department and it was possible to equip each district office throughout the State with portable dictation and transcription machines.

STATE OFFICE BLOCK LIBRARY

A recommendation was made to the Public Service Board for the appointment of an additional library assistant at the State Office Block. Because of the budgetary situation no appointment was made.

In an effort to decentralize some of the work Hawkesbury Agricultural College is now responsible for its own local ordering.

Branch libraries.—Although recommendations were made to the Public Service Board no additional appointments have been made to Wagga Agricultural College and the Agricultural Research Institute; the Royal Botanic Gardens; and Hawkesbury Agricultural College.

Following a fire at the Veterinary Research Station, Glenfield in May and the evacuation of the library, the services of a full-time typist have been made available.

No appointment has been made as yet to Yanco Agricultural College and Research Station Library.

A member of State Office Block Library spent a week assisting the librarian, Biological and Chemical Research Institute.

Orders placed.—A total of 3,125 items as against 3,432 for 1970-1 were ordered or covered by requisitions through local suppliers or the New South Wales Government Offices in London. Of this total 440 were ordered for Hawkesbury Agricultural College; 888 for Wagga Agricultural College; 126 for Yanco Agricultural College and Research Station; and 79 for C. B. Alexander Agricultural College.

For other Departments, 126 items were ordered for Department of Public Works; 22 for Premier's Department; 5 for Local Government; and 5 for Treasury.

Central library accessions.—27,451 items were accessioned as against 29,264 for 1970-1. The 27,451 items comprised 1,257 books, 15,738 new periodical issues, 1,263 annuals, and 9,193 pamphlets. The 9,193 pamphlets comprised 4,128 in series, 362 catalogued, 343 distributed by subject, 1,285 parliamentary papers, and 3,075 miscellaneous. The average weekly rate of items accessioned was 528.

Central library loans.—Loans totalled 47,561 as against 41,416 in 1970-1. The 47,561 comprised 36,884 periodical issues circulated (average 709 per week) and 10,677 miscellaneous loans. Of the 10,677 miscellaneous loans, there were 8,278 to departmental officers; 1,483 to libraries of other institutions; while 916 were borrowed from other libraries, including 475 photocopies supplied instead of loans.

Branch libraries loans.—Total loans were 40,811. Individual loans were Hawkesbury Agricultural College 6,965; Veterinary Research Station Glenfield 14,189; Agricultural Research Institute Wagga 698; Wagga Agricultural College 2,344; Royal Botanic Gardens 1,989; and Biological and Chemical Research Institute 14,626.

Library bulletins.—Twelve bulletins were compiled and distributed totalling 621 pages and 4,808 items as against twelve bulletins totalling 749 pages and 6,360 items in 1970-1.

Literature searches.—Bibliographies produced by literature searches for departmental officers were regularly listed in the *Library Bulletin* and in the period under review 56 searches were listed, 3 fewer than in 1970-1.

Photocopying service.—The total number of jobs arranged through the document reproduction centre was 1,611 involving 9,801 sheets as against 1,692 jobs involving 12,308 sheets in 1970-1.

New exchanges.—Exchanges were arranged for agricultural literature from institutions in Cuba, Japan, Canada, and Thailand.

Translation service.—Departmental officers were supplied with 26 translations from the following languages: German, French, Finnish, and Spanish.

SPECIAL PAPUA-NEW GUINEA ASSIGNMENT

At the request of the Commonwealth Government, Dr F. C. Butler, Senior Deputy Director-General visited Papua-New Guinea for a period of six weeks from early April, 1972.

Dr Butler reviewed and reported on the organization and operation of the agricultural training programmes of the Papua-New Guinea Department of Agriculture, Stock and Fisheries. Aspects of in-service, farmer, subdiploma, and diploma level training were included.

Whilst in Papua-New Guinea Dr Butler examined the relationships between departmental training institutions and other educational institutions including the University of Papua-New Guinea and the Lae Institute of Technology. The role of consultative and advisory bodies in the fields of agricultural education training were investigated.

STAFF

Appointments.—Mr J. F. Dillon, Livestock Research Officer, was appointed to the position of Executive Assistant to the Senior Deputy Director-General.

Mr K. A. J. Wood became Officer-in-Charge, Central Secretariat, after having acted in the position for a considerable period.

Mr C. J. Parker was appointed Staff Clerk following the transfer of Mr H. A. Dickinson to the Agricultural Education Secretariat.

Death.—Mr C. A. Ware, clerical assistant in the Staff and Personnel Section, collapsed and died on his way to work on 12th April, 1972.

Retirement.—Mr S. T. Whiteside retired on 10th March, 1972, having been the personal attendant of Ministers of Agriculture since June, 1964. He had been employed in the Public Service since March, 1947, and was transferred to this Department in 1956. Between 1956 and 1964, he was the personal attendant of successive permanent heads. Mr Whiteside was held in high regard and was a most devoted officer.

New executive position.—After a secondment of 4 years to the Australian Meat Research Committee, Dr R. B. Dun returned to the Department on 27th September, 1971. Dr Dun's appointment was to the newly-created position of Assistant Director-General, in which capacity he is responsible for the oversight and direction of research within the Department. Before his secondment to the Australian Meat Research Committee Dr Dun was Director of Animal Production Research.

DEPARTMENTAL STAFF ESTABLISHMENT AS AT 30th JUNE, 1972

Division/Branch	Professional					General and Ministerial			Administrative and Clerical	Total
	Res.	Ext.	Educ.	Admin.	Total	Reg.	Other	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Central Administration ..	..	..	..	10	10	..	29	29	111	150
Extension Services ..	3	..	..	33	36	..	107	107	72	215
Animal Industry ..	73	127	11	29	240	951	197	1,148	52	1,440
Dairying ..	11	46	10	15	82	..	159	159	8	249
Horticulture ..	21	32	4	15	72	128	11	139	16	227
Plant Industry ..	69	73	..	25	167	17	30	47	17	231
Biological and Chemical Research Institute ..	86	..	..	7	93	..	94	94	6	193
Bio-metrical ..	12	..	..	2	14	..	1	1	4	19
Marketing and Economics ..	35	..	..	6	41	..	15	15	9	65
Research Services ..	33	7	..	28	68	..	434	434	36	538
Royal Botanic Gardens and National Herbarium ..	12	..	..	2	14	..	155	155	3	172
Agricultural Education ..	..	..	71	36	107	..	383	383	37	527
Totals	355	285	96	208	944	1,096	1,615	2,711	371	4,026

Explanatory notes:

- (1) Professional officers whose time is predominantly occupied on research projects and laboratory diagnostic services.
- (2) Professional officers whose time is predominantly occupied on extension to farmers.
- (3) Professional officers whose time is predominantly occupied on agricultural education.
- (4) Professional officers whose time is predominantly occupied on administrative or other activities.
- (5) Does not include 133 agricultural college and university trainees employed by the Department.
- (6) General Division and Ministerial staff whose time is predominantly occupied on regulatory activities.
- (7) Other General Division and Ministerial staff.
- (8) Typists, office assistants, and clerical assistants are included in the General Division figures.
- (9) Only accounting machine operators, stenographers and male clerical positions are included in these figures.
- (10) Trainees are not included.

DIVISION OF EXTENSION SERVICES

FUNCTIONS

Administration and Supervision

- Administer, supervise and co-ordinate the Department's extension services through the nine agriculture regions.
- Administer, supervise and maintain the Department of Agriculture's offices in regions (sixty offices), including all clerical personnel and some general division personnel, such as field assistants.
- The administration of the Commonwealth Extension Services Grant.

Editorial

- Process material for publications; prepare it for submission to the Government Printer or for release to the news media.
- Distribute agricultural information through booklets and leaflets contained in the Department's range of approximately 1,400 miscellaneous publications.
- Supply specialist advice to home gardeners not adequately met by the literature distribution service.

Extension Methods Training

- Develop skills of extension workers in their use of extension methods and their knowledge and understanding of the extension process.

Group Extension

- Provide organizational help to the Agricultural Bureau and promote group extension activities through this and other rural groups, including extension services for rural women.

Audio Visual Aids

- Provide audio visual aids equipment for use by extension workers and develop extension workers skills in their use of aids, including radio and television.

Extension Research/Evaluation

- Review, report and make recommendations on matters relating to the operation, amendment, stimulation, organization and co-ordination of the Department's extension services.
- Encourage and assist extension workers to measure and evaluate the effectiveness of their extension efforts.

Extension Research Liaison

- Promote liaison with research workers in government, universities and commerce.

STAFF

Severance and Appointments

The following severances occurred during the year:

- Mr F. Autry-Hall, Regional Supervisor, Lismore retired;
- Miss E. McMaugh, Extension Officer (Extension Research/Evaluation) resigned; and,
- Mrs J. M. Miller, Extension Officer (Group Extension) resigned.

The more important appointments during the year were:

- Mr J. J. Slater, Principal Extension Officer, to the newly-created position of Deputy Chief;
- Mr H. P. Hall, Regional Supervisor, Lismore;
- Mr F. S. Benecke, District Livestock Officer (Apiculture), to the position of Regional Supervisor, Gunnedah; and,
- Mr B. D. Lenne, Agricultural Extension Officer, Victorian Department of Agriculture, to the position of Assistant Principal Extension Officer (Group Extension).

Conferences and Meetings

Appropriate members of the Division attended the following meetings:

- The 47th State Conference of the Agricultural Bureau (Canberra—7th–9th July, 1971)
- Rural Reconstruction Seminar (Canberra—27th October, 1971)
- Inter-Departmental Workshop on Rural Adjustment (Sydney—1st–4th November, 1971)
- National Workshop on In-Service Training and Development of Extension Workers (Brisbane—17th–21st April, 1972)
- Metric Conversion Agricultural Information Sector Committee (Melbourne—28th June, 1972)

Committees

Members of the Division at head office and regional supervisors were represented on a considerable number of committees during the year. Amongst these were:

- The Advisory Board of Adult Education;
- Metric Conversion Agricultural Information Sector Committee;

- Agricultural Bureau Executive Council;
- Rural Youth State Council;
- Regional Development Committees;
- Regional Advisory Committees;
- Technical College Advisory Committees;
- Irrigation Research and Extension Committee; and,
- a number of Agricultural Research and Extension Committees at regional level.

Training of Overseas Personnel

Officers of the Division have contributed segments on agricultural extension to a number of courses for international fellows studying in Australia. These courses were arranged by the Commonwealth Department of Foreign Affairs, in conjunction with appropriate State Departments of Agriculture, universities and other appropriate institutions.

Additionally, head office staff and regional supervisors have been involved in arranging training experiences and/or study tours for various overseas groups and individuals visiting New South Wales.

NEW DEVELOPMENTS

Regional Boundaries

On the 9th August, 1971, the Premier advised that Cabinet, on the recommendation of the Minister for Decentralisation and Development, had endorsed a proposal that the State be divided into nine regions, and that—within a period of 36 months—these regions be adopted by the Government for all administrative and developmental purposes except to the extent to which they are exempted by the Government.

The Premier stated that the regions will replace the present confused pattern of conflicting areas and districts adopted over the years by the various departments and authorities for their own purposes. Our underlying objective, the Premier said, is increased decentralisation of administration on a co-ordinated basis.

On receipt of this advice, action was taken to examine the situation and its implications for the Department of Agriculture.

On the 14th September, the Chairman of the Public Service Board requested that the Board be advised, not later than 31st October, 1971, as to the action required to be taken in the Department's administration to implement the Government's proposal and of any difficulties likely to be experienced. The Chairman also requested an indication of the date by which "regionalization" is expected to be accomplished. The information required was forwarded to the Chairman of the Public Service Board on 22nd October.

In November, the Premier requested that the results of the Public Service Board investigation be submitted progressively to a Standing Subcommittee of Cabinet, and that the Subcommittee would look closely at all aspects of regional reorganization proposals. The Premier further stated that each individual proposal for the relocation of country establishments and for changes in the staffing structure should be referred to the Cabinet Subcommittee for examination prior to it being adopted or publicised.

The situation has now been reached where proposals concerning this Department have been submitted by the Public Service Board to the Cabinet for further examination.

Amalgamation of the Divisions of Information Services and Extension Services

In October, 1971 the Public Service Board approved of the amalgamation of the Divisions of Information Services and Extension Services under the title Division of Extension Services. At the time of the amalgamation, the Division of Information Services comprised two main sections—the Editorial Section and the Department's Library Services. It was resolved that the Editorial Section, with its various subcomponents, should become part of the Division of Extension Services, but that the Library Services would, in future, be administered by the Agricultural Education Secretariat.

Extension Research and Evaluation Unit

The Extension Research and Evaluation Unit, established early in 1971, commenced two research projects. One project is examining the distribution of work time of extension officers and its relationship to training and other factors. The second project is concerned with changes on farms and the exposure of farmers to information. These projects are recorded in section 3 of this report.

Officers of the unit also encouraged and assisted district extension officers in the evaluation of their own work.

A paper on evaluation was prepared and distributed within the Department. It emphasized the value of continuing informal evaluation of extension programmes and methods. There was a considerable demand for copies of the paper from other State extension services and teaching institutions.

Improved Procedures

Leave records.—Responsibility for the maintenance of leave records has been transferred from head office to the Mid-Coast and Hunter, South Coast and Tablelands, and Southern Regions. This arrangement will operate on a trial basis from the 1st July, 1972. If found to be satisfactory, maintenance of leave records will be transferred to all regions.

Organization and methods survey—Western Region.—An organization and methods survey was conducted in the Western Region. The survey team, together with the regional supervisor, visited all offices within the region. Interviews were conducted with all officers. These were followed by further interviews at regional headquarters. Officers expressed appreciation for the assistance provided by the survey team during the course of the interviews.

Photographic processing.—Improved methods were adopted in photographic processing procedures.

RETIREMENT OF H. PARRY BROWN

Mr H. Parry Brown retired on 12th November, 1971, after 42 years service to the Department and the State. He was successively a plant pathologist, State Organizer of the Agricultural Bureau, Chief of the Division of Information and Extension Services from 1948 and then from 1957 Chief of a renamed Division of Information Services.

Mr Brown had an immense influence on agricultural extension services in this State. In particular his contributions included development of the theory and philosophy of extension and the initiation and improvement of in-service training. Mr Brown's stress on the role of extension workers as agents of change had profound effects which will long be apparent in the approach to extension. Mr Brown was widely respected in all States of Australia for his knowledge of extension. His correspondence with extension specialists in other countries provided further stimulus to the evolution of extension services in Australia.

DIVISION OF ANIMAL INDUSTRY

FUNCTIONS

The Division of Animal Industry is responsible for research, extension and regulatory control relating to livestock production and disease. Research is conducted into diseases of all classes of livestock and into the breeding, nutrition and management of sheep, beef cattle, pigs, poultry, and bees, together with nutrition of dairy cattle. Noxious animal research is also undertaken.

Extension is directed at educating stockowners in procedures aimed at improving efficiency of management and nutrition of sheep, beef cattle, pigs, poultry, Angora goats, and bees, together with methods of preventing and controlling diseases in these species and also dairy cattle. Regulatory control is exercised over scheduled diseases of livestock and bees, the identification of livestock and the control of noxious animals and plague locusts.

The Division is responsible for inspection of meat for local consumption at the State's major abattoirs. It administers Government drought relief, travelling stock reserves, public watering places and the registration of stock foods and medicines. On behalf of the Commonwealth Government, the Division administers the sections of the Quarantine Act relating to the import and export of animals and animal products.

STAFF

Vacancies

Four veterinary officers resigned and at the end of the year there were six vacancies for veterinary officers. Attempts to fill these vacancies were unsuccessful.

A position of research officer, Cattle Tick Research Station, Wollongbar, could not be filled from trainee graduates. A vacancy for a research officer to undertake sheep blowfly research could not be locally obtained and was advertised overseas.

Staff Changes

The retirement took place of Mr N. A. Steel, Principal Livestock Officer (Pigs) after 35 years of service within the Department. He had served at Hawkesbury Agricultural College, head office and Lismore before being appointed as Principal Livestock Officer (Pigs). Further retirements were Mr G. H. Simpson, District Livestock Officer (Pigs) Wagga and Mr K. Bray, Veterinary Inspector, Mudgee.

Deaths are recorded with regret of Mr G. J. Fisher, District Veterinary Officer, Homebush and Mr E. R. Tuchy, Veterinary Inspector, Forbes.

Mr P. McInnes was appointed as Director of Animal Production Research, Mr J. J. Mannion as Pastures Protection Officer and Mr J. P. Whelan as Senior Clerk of the Division.

Overseas Visits

Mr D. G. Christie, Principal Veterinary Officer visited the United States to observe control of virulent outbreaks of Newcastle disease, mastitis and problems associated with feedlots.

Mr R. D. Eastoe, Principal Livestock Officer (Sheep and Wool), went to India and Korea concerning Colombo Plan sheep projects in those countries.

Mr D. H. Mumford, Assistant Principal Veterinary Officer (Disease Control) visited the United States to observe control of outbreak of Venezuelan encephalomyelitis of horses.

Mr B. R. Wilson, Livestock Research Officer went to New Zealand to assess pigraising systems and marketing of pigs.

Mr D. J. Marshall, Livestock Officer (Sheep and Wool), inspected livestock projects in United States, Europe, and Asia under the Star Rural Youth Travelling Scholarship.

Committees

Some of the more significant committees and organizations on which the Division has been represented are:

- Board of Veterinary Surgeons
- Stock Medicines Board
- N.S.W. Meat Industry Authority
- Dairy Industry Artificial Breeding Advisory Board
- Poisons Advisory Committee
- Commonwealth and State Veterinary Committee
- Pastures Protection Board Council of Advice
- Cattle Tick Control Commission
- Cattle Tick Research Advisory Committee
- Poultry Advisory Board
- Mastitis Control Co-ordination Committee
- Standing Committee on Drought Relief
- Veterinary Public Health Committee of the National Health and Medical Research Council
- Australian Chicken Meat Research Committee

Assistance to Overseas Personnel

An international poultry seminar was conducted in liaison with the Commonwealth Department of Foreign Affairs for twenty-one government officers from Korea, India, Philippines, Indonesia, Africa, Fiji, Malaysia, Singapore and Thailand. Two students from Indonesia spent a period at the Veterinary Research Station, Glenfield gaining experience. Mr Lam Mai, a Colombo Plan fellow from Malaysia commenced a 12 months tenure of the position of Veterinary Inspector, Condobolin, before returning to Malaysia.

Technical expertise was provided for the Department of Foreign Affairs in the selection and preparation of sheep for consignment to Colombo Plan projects in India and Korea.

NEW DEVELOPMENTS

The drought relief section, previously part of the Division of Research Services, was transferred to the Division of Animal Industry.

Construction proceeded to near finality on the noxious and feral animal research laboratory and the tuberculosis and brucellosis wing at the Veterinary Research Station, Glenfield. Two silos were built as part of the drought-feeding unit at this station. Tenders were called for the construction of a district veterinary laboratory at Wagga. Responsibility for work on cattle tick fever was transferred from the Cattle Tick Research Station, Woolongbar, to the District Veterinary Laboratory, Wollongbar.

The meat inspection section, took over the meat inspection work at the Newcastle, Maitland, and Wyong abattoirs.

A review of procedures associated with the clearance of passengers at Sydney airport led to a reorganization of quarantine staff.

Cabinet approved the preparation of legislation to repeal the Swine Compensation Taxation Act and to amend the Swine Compensation Act. Pending these actions, the Minister for Agriculture approved the waiving of the swine stamp duty tax.

LIVESTOCK NUMBERS

At 30th June, 1972, there were approximately 27,000 sheep on departmental properties, the majority being used for research purposes. Returns from the sale of wool, sheep, and lambs was approximately \$150,000.

Beef cattle numbered 4,690 head. The sale of beef bulls realised \$16,000.

The Large White, Landrace and Berkshire pig breeds were maintained at Hawkesbury Agricultural College. Because of their low significance in the pig industry, the Tamworth breed was disposed of. Large White herds were maintained at Wollongbar and Grafton Agricultural Research Stations. Disposal of the Berkshire herd at the latter station commenced so that the Large White herd could be increased. Breeding pigs in the Departmental herds numbered 136. Sales of pigs realized \$25,116.

The Department owned 204 horses. Horse sales realized \$10,800.

DIVISION OF DAIRYING

FUNCTIONS

The Division of Dairying has three functions:

- extension;
- regulatory;
- research.

It is the Division's responsibility to guide the industry through all phases of farm production to marketing of dairy products.

Extension Aims

- Improve farming and animal husbandry techniques.
- Improve stock quality and production through its herd improvement scheme.
- Improve milking shed management and milking machine efficiency.
- Ensure production of high quality milk and cream.
- Ensure production of high quality manufactured dairy products.

Regulatory

Responsible for administering the Dairy Industry Act and certain provisions of the N.S.W. Pure Food Act which are designed to:

- safeguard farmers interests;
- enforce prescribed product standards;
- ensure satisfactory standards of hygiene at farm and factory;
- examine and issue certificates of competency for factory personnel;
- register dairy produce factories and stores;
- check, grade and test milk and cream.

Research

Carry out research on new and existing milk products and dairy foods, sanitizers, milking machines, mastitis control, herd recording and nutrition and genetics of dairy cattle.

STAFF

Vacancies

Difficulty was experienced in obtaining suitable applicants for a position of dairy officer (research) vacated in February, 1972 and not filled until June, 1972.

The position of assistant principal dairy officer (extension) became vacant in January, 1972 and had not been filled at 30th June, 1972. The delay was caused by an appeal against the appointment of the occupant to the position of principal dairy officer (extension).

Retirements

Mr D. R. Scott, Principal Dairy Officer (Extension) retired on 31st December, 1971.

Douglas Rutherford Scott joined the Department of Agriculture as a herd recorder 4th July, 1930 and resigned 6th August, 1931. He rejoined the Department as an assistant dairy supervisor in 1939. In the intervening period he obtained the Hawkesbury Agricultural College Diplomas in Dairying and Agriculture.

He served at Wagga, Coff's Harbour, Head Office, and Grafton as a dairy officer and at Deniliquin and Parramatta as district dairy officer.

In 1964 he was promoted to special dairy officer and in 1965 to principal dairy officer. During his period of nearly 34 years service he rendered valuable assistance in many aspects of the dairying industry.

Appointments

Mr L. G. Boutcher, Assistant Principal Dairy Officer (Extension) to Principal Dairy Officer (Extension) on 4th January, 1972.

Mr T. Brock (new appointee) as Dairy Officer (Research) Hawkesbury Agricultural College on 19th June, 1972.

Mr K. Hammond (departmental trainee) to Livestock Research Officer on 4th January, 1972.

Mr D. B. Heptonstall, Senior Livestock Officer (Dairy Cattle) to Assistant Principal Dairy Officer (Herd Improvement) on 1st November, 1971.

Committees

The Division was represented on the following bodies:

- Artificial Breeding Advisory Board—Dairy Industry Authority.
- Dairy Industry Authority Research Committee.
- Dairy Husbandry Research Foundation.
- Dairy Research Advisory Committee.
- Steering Committee for the Biennial Milking Machine Conference.
- Dairy Farm Management Course—Commonwealth Organizing Committee.
- Advisory Committee to Board of Studies on Technical Training Courses.

Overseas Visit

The assistant principal dairy officer (research) is visiting England between December, 1971 and October, 1972. Portion of the absence is recreation and long service leave. The remainder is special leave to enable him to spend time working with the National Institute for Research in Dairying at Shinfield in England as well as visiting several research institutes in Europe.

Training of Overseas Personnel

Mr D. B. Heptonstall, Assistant Principal Dairy Officer (Herd Improvement) was seconded to the Commonwealth Government for 4 weeks during which he acted as tour director for a Dairy Industry Seminar and Study Tour for delegates from the developing countries. The seminar included 1 week of study in N.S.W. and Victoria and 2 weeks in New Zealand. Twenty-two delegates from eleven countries attended the seminar which was sponsored jointly by the Australian and New Zealand Governments under the Colombo Plan, the Special Commonwealth African Assistance Plan and the South Pacific Aid Programme.

NORTH COAST DAIRY FEED YEAR ASSISTANCE SCHEME

The 5-year term of the Dairy Feed Year Assistance Scheme concluded on 30th September, 1971.

The revised scheme, which is to run for 3 years on a reduced financial basis, commenced on 1st October, 1971.

During the 5 years of operation of the original scheme, applications were received for assistance to improve a total area of 247,889 acres.

Particulars of applications received during the period are as follows:

Year	Number of eligible dairy farms	Number applying for assistance	Percentage applying	Average acreage applied for
1966-7	4,993	3,616	76	18.8
1967-8	4,611	3,408	73	19.1
1968-9	4,211	3,150	74	19.2
1969-70	3,887	2,708	70	18.9
1970-1	3,305	2,354	72	19.5

Because of the relatively high percentage of eligible farmers making use of the scheme it has proved a very useful method of providing extension contact with farmers who otherwise may have had little or no contact with departmental officers.

District dairy officers and some dairy officers have been involved in administering the scheme. A statement of the cost to the State is shown in appendix I of this report.

DEPARTMENTAL DAIRY HERDS AND PRODUCTION

Departmental dairy cattle studs are located at agricultural colleges and research stations throughout the State.

During 1971-2 Australian Illawarra Shorthorn (A.I.S.) and Polled Jersey herds at Grafton Agricultural Research Station were transferred to other departmental institutions. The A.I.S. were transferred to the C. B. Alexander Agricultural College and the Poll Jerseys to both Wagga Agricultural College and the Bega Dairy Demonstration Farm. Surplus animals to departmental requirements from this latter herd were sold to commercial dairy farmers.

The location of stud herds at agricultural colleges has the advantage of demonstrating sound breeding principles to students whilst enabling the resources of all herds to be drawn on for the breeding of bulls for use in artificial breeding.

The breeding of high quality animals for commercial farmers is a prime objective of the Department in maintaining these studs whilst the use of a suitable animals for research, student demonstrations and projects have been strongly encouraged.

The demand for stud cattle, in particular Friesians, has continued to be very keen. Heifers offered at the Friesian Cattle Club annual breed sale from Hawkesbury Agricultural College brought the top and equal second top prices of \$1,100 and \$1,000 respectively. A yearling bull in Western Australia, whose dam was purchased from the Hawkesbury Agricultural College herd, was sold for a breed record price of \$1,850.

Herd Production

All herds were recorded under the official section of the herd production improvement scheme and were among the leading herds for the respective breeds.

The following table lists the production details for each herd for 1970-1, which is the latest information available:

	Milk (lb)	Test	Butter fat lb	Number of Cows
Hawkesbury Agricultural College (Friesians)	13,531	3.7	506	49
Wagga Agricultural College (Jerseys)	7,437	5.0	371	44
Grafton Agricultural Research Station (A.I.S.)	9,429	4.3	405	35
Yanco Agricultural College (Guernseys)	9,092	5.2	477	32

Stock Sales

Ninety-seven (97) stud animals were sold to commercial dairy farmers for a total of \$16,235. These were made up as follows:

	Head	\$
Hawkesbury Agricultural College (Friesians)	31	8,040
Grafton Agricultural Research Station (Jerseys)	38	3,270
Grafton Agricultural Research Station (A.I.S.)	11	1,700
Yanco Agricultural College (Guernseys)	10	1,945
Wagga Agricultural College (Jerseys)	6	1,045
C. B. Alexander Agricultural College (Friesians)	1	235

Show Exhibits

Friesian and Guernsey teams from Hawkesbury and Yanco Agricultural Colleges, respectively, were exhibited at the 1972 Royal Easter Show with limited success. Friesians obtained one first and four third placings whilst the Guernseys secured four third placings.

Country shows at Leeton, Wagga, Hawkesbury, and Maitland were patronized by the appropriate local institution. The Australian Illawarra Shorthorn exhibit at Maitland from the C. B. Alexander Agricultural College was the initial exhibit from that college. The results were very pleasing with eight first placings being won.

DIVISION OF HORTICULTURE

FUNCTIONS

The Division of Horticulture is predominantly concerned with the production, marketing and export of fruit. Its research, extension and regulatory services are designed to assist the various industries involved in the growing and post-harvest handling of these fruit crops, including citrus and tropical fruits, wine, drying and table grapes, apples and pears, stone fruits, berries, nuts, and canning and juice fruits.

Research

Research officers are located on research stations and laboratories on the North and Central Coast, Sydney, Central Tablelands, Murrumbidgee Irrigation Areas, and the Lower Murray River (Sunraysia). The research programme includes evaluation of rootstocks and scions, clonal selection, soil and irrigation management techniques, high density planting, hedging and topping, use of growth regulators for growth and cropping control (fruit set, thinning and maturity studies), mechanical harvesting, post-harvest rot control, fruit storage at low temperatures and in controlled atmospheres to delay senescence, control of storage disorders, waxing, packaging and transport.

Extension

Extension officers are located in all the major fruit producing areas of the State with the primary objective of assisting the rural community, through education, to realise the maximum benefit from the use of available resources. The extension service is the essential link between research and commercial practice. It is the means by which growers are encouraged to use efficient methods and adopt improved techniques arising from research conducted by the Division and other organizations.

Regulatory

Inspectors (Plant Diseases Act) enforce legislation concerned with marketing of fruit and vegetables and protection of fruit and other crops against infestation with pest and disease. They are located in country and metropolitan centres and at the Export and Import Branch of the Division in Sydney. On behalf of the Commonwealth the regulatory service implements plant quarantine regulations for N.S.W. to prevent the introduction of further pests and diseases into Australia, and export regulations in respect to plants, seeds, fruit, vegetables, wheat and other grains and flour.

STAFF

The shortage of trained extension officers, competent to assume district responsibilities, continued. At the end of the year three districts were without the services of resident fruit officers (extension).

Severances and Appointments

Mr A. Catley was appointed to the position of Scientific Officer (Regulatory) and Mr R. S. Sproule to the position of Special Fruit Officer (Irrigation Areas).

Mr R. E. Smart, Fruit Officer (Research), Viticultural Research Station, Griffith, resigned to take up an Auscott Scholarship and commenced study towards a Doctor of Philosophy degree at the Cornell University, New York.

Mr R. W. Robertson, Senior Inspector, Export and Import Branch, retired and Mr R. Milburn, Deputy Senior Inspector, was promoted to Senior Inspector, whilst Mr R. New, Supervising Inspector, was promoted to Deputy Senior Inspector.

The death occurred of a former Chief of the Division, Mr R. G. Kebby.

Overseas Visits

Mr C. H. Mort, Principal Fruit Officer (Stone), visited Italy, United Kingdom, Canada and the U.S.A. to study fruit harvesting developments, with particular reference to the mechanical harvesting of fruits for processing.

Mr D. S. Leigh, Principal Fruit Officer (Tropical), visited the U.S.A., Mexico, Central America, West Indies, United Kingdom, Israel and South Africa during the course of a tropical and subtropical fruits study tour particularly to obtain information on propagation techniques and variety improvement.

Mr M. S. G. Penfold, Inspector Plant Diseases Act, spent 3 months in South Vietnam with the Army initiating quarantine procedures and inspections of service equipment being returned to Australia. The Commander, Australian Forces in Vietnam, highly commended Mr Penfold's work.

Committees

The Division was represented on the following more significant committees:

- Commonwealth and States Horticultural Committee.
- Canned Deciduous Fruits Industry Advisory Committee.
- Committee for Co-ordination of Fruit and Vegetables Storage Research.
- CSIRO Vine Improvement Research Committee.
- Dried Fruits Research Committee.
- Commonwealth Grape Advisory Committee.
- M.I.A. Irrigation Research and Extension Committee.
- Central Coast Agricultural Research and Extension Committee.
- Committee for Fruit and Vegetables Storage Investigations in N.S.W.
- M.I.A. Fruit Fly Committee.
- Citrus Wastage Research Committee.
- Banana Marketing Control Committee.

Assistance to Overseas Personnel

Considerable assistance was rendered to the Department of Foreign Affairs in arranging and conducting an International Training Course in Horticulture for international fellows studying in Australia. The Division undertook the responsibility of providing detailed training in banana and citrus culture and orchard irrigation. The assistance included preparation of written notes, lectures, discussions and conduct of relevant tours in N.S.W.

Assistance was also provided to the following overseas visitors:

Dr L. A. Lider, Professor of Viticulture, University of California.

Mr D. C. Lotter, Estate Director, Consolidated Citrus Estates, Transvaal, South Africa.

Dr S. D. Goldberg, Professor of Irrigation, Hebrew University of Jerusalem, Israel.

Dr A. J. Heyns, Deputy Director, Department of Agricultural Technical Services, Fruit and Food Technology Research Institute, Stellenbosch, South Africa.

Messrs. A. Peled and Y. Halevy, Research Division, Banana Growers Association, Israel.

Dr S. Okamoto, Professor of Citriculture, Shizuoka University, Japan.

NEW DEVELOPMENTS

The N.S.W. Plant Diseases (Amendment) Act, 1971, considerably extended the scope of the Plant Diseases Act. One outcome was the involvement of inspectors in disease outbreaks affecting forest plantations. There has been a significant increase in regulatory attention to pests of stored grain and other products affected by stored grain pests.

DIVISION OF PLANT INDUSTRY

FUNCTIONS

The functions of the Division of Plant Industry are mainly in the broad fields of agronomic research and extension. The Division also administers the Agricultural Seeds Act and for this purpose has a small regulatory staff of three inspectors, a seed testing laboratory and a staff of seed analysts.

The Division is responsible for research and extension with the whole range of field crops and pastures, vegetables, fodder conservation, seed production, weed control, irrigation and cloud seeding.

The research activities of the Division include plant breeding, plant introduction, investigation of cultural practices, times, rates, and methods of sowing, plant nutrition, species testing, establishment and management of pastures, irrigation techniques, seed production, fodder conservation and weed control.

Extension activity, or the dissemination of agricultural information, covers all aspects of crop production, farm management and pasture improvement.

STAFF

Vacancies

For most of the year the Division has had no significant vacancies in the establishment positions for professional officers. In contrast to previous years, the main problem has related to the provision of positions for the intake of trainees who have completed their courses at universities and agricultural colleges, and for the absorption of officers whose positions were terminated for lack of continued financial support from outside sources.

Five pasture research agronomists completed two- to three-year training periods with CSIRO, their salaries and costs having been paid from the Wool Research Trust Fund. Moreover, salaries for three research positions are no longer supported by various industry funds and Consolidated Revenue support was withdrawn from one position at the end of the year. In order to place these officers it has been necessary to utilize the positions of resigned officers, and four positions of agronomists-in-training for extension have had to be used to absorb research agronomists.

Following many years during which varying numbers of district agronomist districts were constantly vacant, all these positions have been occupied since 27th March, 1972. Five agronomists have completed in-service training to permit their appointment as district agronomists as soon as vacancies occur.

Appointments and Severances

Six agronomists resigned during the year, four transferred to other Divisions and one died. Recruitment of eleven agronomists comprised seven former trainees, one returned from national service, two transferred back from other Divisions and one from the Soil Conservation Service. Thus the total professional staff remained unchanged.

Overseas Visits

Dr D. J. McDonald, Research Agronomist (Rice Breeding) represented Australia at the International Rice Breeding Symposium, held at the International Rice Research Institute, the Philippines, in September 1971. He also visited rice research centres in Japan and Thailand.

Conferences and Committees

Three agronomists attended the Australian Plant Breeding Conference in Perth, in August 1971, ten attended the Australian Rice Research Conference at Yanco in February 1972 and three attended the Australian Potato Agronomy Conference in Burnie, Tasmania in March 1972.

The principal agronomist (extension) attended the interdepartmental Workshop on Rural Adjustment, held at Little Bay, Sydney, from 1st to 4th November, 1971.

Some of the more significant committees on which officers of the Division represent the Department are:

- N.S.W. Standing Advisory Committee on Wheat.
- Guidelines Committee advising the Rural Assistance Board.
- State Regional and Project Planning Committee (under the State Planning Authority of N.S.W.).
- State Committees on Flood Relief and Bush Fire Relief.
- Interdepartmental Standing Committee for Aboriginal Welfare.
- State Wheat Improvement Committee.
- New South Wales Advisory Committee on Wheat Production and Marketing.
- N.S.W. Tobacco Advisory Committee.
- Australian Weeds Committee.
- Noxious Plants Advisory Committee.
- The Hunter Valley Conservation Trust.
- New South Wales Wheat Standards Committee.

Assistance to Overseas Personnel

Indo/Australian Sheep Breeding Centre—Hissar, India.—The principal agronomist (irrigation), the principal agronomist (seed production) and the principal livestock officer (sheep and wool) constitute the Technical Advisory Committee assisting the Department of Foreign Affairs to establish this farm under the Colombo Plan.

The officers visited the farm in March, 1972, for the third time. The project is entering a very interesting stage with the completion of 400 acres of irrigation development which is now under production. Over the next four to five years a further 2,600 acres will be developed to irrigation.

Sheep Demonstration Farm at Unbong, South Korea.—The principal agronomist (seed production) and the principal livestock officer (sheep and wool) also constitute the Technical Advisory Committee assisting the Department of Foreign Affairs in the establishment of the Sheep Demonstration Farm at Unbong, South Korea, which is being established with Colombo Plan assistance.

In March, 1972, they inspected this project for the second time.

Seed Production Training Course for Asians and Africans.—The New South Wales Department of Agriculture together with the Queensland Department of Primary Industries and the Victorian and South Australian Departments of Agriculture co-operated with the Department of Foreign Affairs in providing a 3 months training course in Seed Production and Certification for seventeen fellows from Asian and African countries.

International Training Course in Horticulture.—The Division of Plant Industry participated in the planning of the International Training Course in Horticulture which covered vegetables as well as fruit crops. Individual head office and district officers assisted in instructional and field sessions of the course.

NEW DEVELOPMENTS

New Seed Production Section

A Seed Production Section within the Division of Plant Industry was established in January 1972. This section is responsible for seed production of all field crops and pasture species particularly when seed is being produced under departmental supervision. The section also includes the Seed Testing Laboratory.

The section was established to consolidate the various seed production activities of the Division, to provide better liaison with the various segments of the seed industry and with other State and Commonwealth Departments, particularly in view of the potential export market for seed opened up by Australian participation in the O.E.C.D. Seed Certification Scheme.

Agricultural Seeds Act

A major revision of the Agricultural Seeds Act was completed during the year.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE

FUNCTIONS

The Biology Branch carries out research on all aspects of disease of plants caused by parasitic organisms and non-parasitic agencies, factors influencing the successful establishment of legume nodule-producing bacteria in the soil and on the plant and biological quality of locally-produced and imported dairy products. Results of research and advice are passed to other interested authorities, the rural community and field officers of the Department.

The overall function of the Chemistry Branch is to bring to the agricultural and allied industries the benefits of research in and knowledge of chemistry and related sciences.

The Entomology Branch has a primary function of developing new and improved methods of insect pest control as an important factor in efficient and economic production by primary industry. The integration of the results of this research into farming practice is ensured by liaison with the Department's extension services and direct service to those responsible for agricultural production.

STAFF

Vacancies

The position of plant pathologist, Agricultural Research Station, Wollongbar, remained unfilled during 1971 but has now been filled by Mr J. Hellmers, Plant Pathologist, who is undergoing in-service training at Rydalmere before proceeding to Wollongbar.

There are three vacancies for entomologists which assume greater importance than ever before because of the increasing pressure for entomological research to be stepped-up for the resolution of insect control problems now compounded by insect resistance, insecticide residues and the community concern for contamination of the environment.

Deaths

Mr C. R. Wallace, Entomologist, died on 17th December, 1971, after an illness of several weeks. Ron Wallace had been employed with the Department for almost 29 years—from 12th March, 1928 to 30th November, 1951 and from 3rd January, 1967, until his death. His research in recent years had been centred largely upon field crop and pasture insects and he was an authority on the black beetle which has been such a serious pest mainly in coastal areas of New South Wales. The death of this senior, experienced entomologist was an important loss to the Entomology Branch and to field crop and pasture pest research in particular.

Mr I. de L. Mosse-Robinson, Entomological Assistant, died suddenly on 4th December, 1971. Ian Mosse-Robinson who had been employed by the Department of Agriculture for 22 years had played an important role since 1956 in the highly successful fruit fly disinfestation research programmes at Gosford.

Committees

Some of the more significant representations on outside committees were:

- Commonwealth Co-ordinating Committee on Pesticides and Pesticides Subcommittee.
- N.S.W. Public Service Metric Advisory and Co-ordinating Committee.
- Technical Advisory Committee of the State Pollution Control Commissions.
- Subcommittee of the Commonwealth and States Horticultural Committee.
- Science Advisory Committee—Board of Rural Studies.
- Australian Society of Dairy Technology.
- Commonwealth and States Entomology Committee.
- Pesticides and Agricultural Chemicals Subcommittee, National Health and Medical Research Council.
- Argentine Ant Eradication Committee.
- Fresh Fruit Disinfestation Committee.

Training of Overseas Personnel

Mr F. A. Mughal, Senior Plant Protection Assistant, Gilgit, Pakistan, was given training for a period of 2 months in plant pathology and entomology.

Mr D. T. Weerasekera, Research Officer (Soil Microbiology) Ceylon, was trained for a period of one year in 1971–2 in rhizobiology.

In the Chemistry Branch Mr M. Aslam of Pakistan was provided with training for 3 weeks in October, Mrs Y. Aguru of Thailand for 9 months from November and Mr J. C. Marsh of Liberia returned for 6 weeks training in December/January following a previous 6 months completed in March, 1971.

NEW DEVELOPMENTS

Changes in emphasis include increasing use of instrumentation; more attention both in regard to research and to certification to crops other than wheat, e.g. sorghum and oilseed crops; increased interest in soil physics, trickle irrigation, mushroom compost quality and rice quality.

The development of the integrated pest control concept as the basis for the Entomology Branch approach to insect pest problems is directed into three main avenues of investigation—bioassay, ecological and new approaches. A systematic approach is essential to ensure the discovery of all suitable techniques which can be utilized in a compatible manner to reduce pest populations and maintain them at levels below those causing economic injury.

A new section has been created in the Entomology Branch dedicated to investigation of new approaches, largely non-chemical, to insect control. Initial investigations have been directed at physiological responses associated with insect behaviour and early results have shown sufficient promise to warrant further investigation for practical application.

R.A.S. Show Judging

A report was prepared for submission to the Royal Agricultural Society Council commenting on proposed changes for the judging of wheat in the District Court competition and at the same time dispensing with the Open Wheat Classes judging, which it is now generally agreed have outlived the purpose for which they were originally intended. The Open Wheat Classes, which are supported by the N.S.W. Flour Millers Council, have been in existence for over 30 years and it is considered that their extension value has now become immaterial and that greater emphasis on quality can best be achieved by concentrating on wheat entries in the District Court Competition.

BIOMETRICAL BRANCH

FUNCTIONS

The staff of the Biometrical Branch consult with and advise other research workers in the Department on the design of experiments and on their analysis and interpretation; and on sampling and survey methods and other statistical and mathematical problems. At the beginning of an investigation, the biometrician helps to clarify and define objectives, to select the precise questions to which answers are to be sought and to decide the exact plans and procedures to be followed. On completion of the experimental work he carries out the appropriate statistical analysis, advises on the interpretation of the results and may assist in the preparation of material for publication.

Committees

The Chief Biometrician is a member of the Mathematics Course Assessment Committee formed by the Advanced Education Board. During the year the committee considered proposals of the Mitchell College of Advanced Education for courses in mathematics at degree level.

NEW DEVELOPMENTS

Virtually all calculations are carried out on computers now so the branch can only work efficiently if computing is efficient. Records of the work done by the Treasury ADP Service Bureau for the Biometrical Branch show that analyses of variance and regression work take $4\frac{1}{2}$ days on the average to be completed, development work on programmes 4 days and special jobs 6 days. Delays of this order are most inconvenient for the biometricians and can lead to serious delays in the analysis of experiments. The branch has been able to carry out urgent work through a time-sharing terminal financed by Commonwealth Extension Services Grant (CESG). Originally only one firm could be used and unfortunately its computer was not large enough to handle our main programmes. However, other firms with large computers introduced time-sharing systems this year and the branch now uses the firm that can carry out a particular job most efficiently. Terminals incorporating card-readers and high-speed printers are now available and work is being planned for this type.

A position of biometrician was transferred from Sydney to Tamworth Agricultural Research Station and a position of machine operator created there. This is the second position of biometrician to be transferred to a research station and arrangements are being made to transfer another to Wagga Agricultural Research Institute.

The allocation of work in the branch has been changed so that each biometrician is now responsible for work on a particular crop or topic. In this way it is hoped to improve the biometrician's knowledge of the special features of experiments with particular crops.

DIVISION OF MARKETING AND ECONOMICS

FUNCTIONS

The Division of Marketing and Economics undertakes research into all aspects of the production, marketing, and handling of agricultural products, including development of research and extension methodology in agricultural economics and farm business management; provides advice on commodity prospects, marketing schemes and rural policy generally, and working mainly through other Divisions provides extension services in agricultural economics and farm business management. The Division also provides specialized liaison and in-service training in agricultural economics and farm business management to both departmental research and extension officers.

The Division publishes a journal, the *Review of Marketing and Agricultural Economics*; and a bulletin series which under the general title of *Miscellaneous Bulletin* reports a variety of research studies, survey results and data collections. A number of regional economists publish local bulletin series to provide farmers and others with farm management and agricultural economics data.

A complete price reporting service is provided for all produce markets in the Sydney metropolitan area and a retail price reporting service for meat, fruit and vegetables, and certain other commodities. The Division also provides crop forecasts, and market outlook and commodity information for a number of products. It also administers the Marketing of Primary Products Act, 1927, under which a number of primary produce marketing boards are constituted, and provides a member on a number of those boards. The Division also provides a representative on a number of other State and Commonwealth Boards and Committees. Under the terms of the Dairy Industry Authority Act, the Division conducts cost-income surveys of all aspects of the dairy industry in New South Wales.

STAFF

Official Overseas Visit

Late in the year the Chief of the Division participated in the New South Wales Government 1972 Trade Mission to South-East Asia, visiting Malaysia, Singapore and Indonesia.

Committees

The Chief of the Division continued as New South Wales Government representative on the Australian Tobacco Board. The Chief has also acted as State Agent on the Tobacco Industry Leaf Finance Agency.

The Chief continued as a member of the Dairy Industry Prices Tribunal and as a departmental representative on the State Development Co-ordinating Committee and the Markets Joint Subcommittee of the Illawarra Regional Development Committee.

The Chief also continued as Chairman of the Advisory Committee for the Diploma in Agricultural Courses—Business and Social Studies, and as a member of the Board of Studies. He was also appointed to the Board of Studies for Orange Agricultural College and to the interdepartmental Committee on Rural Adjustment.

The Deputy Chief, continued as a representative of the Standing Committee on Agriculture to the ACCRA Committee (Australian Committee for Coding Rural Accounts), and as Convener of an interstate Committee appointed by the Standing Committee on Agriculture to investigate farm management services provided by the Australian States. He was appointed a Government nominee on the Oats Marketing Board for the State of New South Wales.

The principal extension economist was a member of the Organizing Committee for the 1972 Commonwealth Refresher Course in Dairy Farm Management.

The special economist (crop forecasting) is a member of the interdepartmental Committee on Coarse Grains and chairman of the New South Wales Wheat Forecasting Committee and was appointed a member of the Barley Marketing Board for the State of New South Wales.

The special economist (commodities) in addition to being deputy member on the Australian Tobacco Board is a ministerial nominee on the Grain Sorghum Marketing Board for the State of New South Wales. He also acts as a permanent observer on the Committee of the Commonwealth/Industry Conference on Vegetable Oilseeds, Oils, and Meals.

Mr B. B. Coomber, Economist, was appointed a member of the Wine Grapes Marketing Board for the Shires of Leeton, Wade, and Carathool.

Staff Training

A significant feature of the Division's in-service training is to encourage officers to participate in professional conferences and courses and to undertake post-graduate studies. Also as a part of in-service training during the year two economists attended courses in computer uses.

During the year economists attended technical and management oriented professional conferences organized by the Commonwealth Government, various universities, professional institutes and societies. At 30th June, 1972, eleven economists were enrolled for Masters degrees, one on a full-time basis, and two were undertaking formal study for a Doctor of Philosophy degree. Four economists were undertaking other post-graduate studies in the area of business management, accountancy, and law.

During this year one economist successfully completed the Diploma in Rural Accounting, two were awarded a Masters degree, and one a Doctor of Philosophy degree, whilst another officer had completed all the requirements of a Ph.D.

NEW DEVELOPMENTS

During the year there was a significant consolidation of professional staff following the rapid build-up of the last 3 years. With the return of a number of senior economists from study leave the supervision problems which have been restricting activities for some time have been largely resolved.

During the year a revision was begun of the Marketing of Primary Products Act, 1927. Due to the complicated nature of this Act, the review will take some time to complete. Another significant development relating to marketing boards was the increase in the number of divisional economists who are members of boards from one to four. Although this policy should greatly assist the efficient operation of the relevant boards, it does pose a strain on divisional resources.

Policy Advice

The Division is called upon to provide a considerable amount of policy advice to the Department and the Minister; particularly concerning the marketing of various agricultural products, and the question of marketing or production quotas to control surplus production. Specifically the Division has been concerned with marketing and production policies for wheat, eggs, dairy products, sheep meats, canned deciduous fruits, cotton and tobacco, and with market prospects for alternative enterprises especially coarse grain and oilseed crops; the Chief accompanied the Minister and Director-General to all meetings of the Australian Agricultural Council and the Standing Committee on Agriculture during the year.

Rural Adjustment

The Division was intimately involved with the Departmental developments in rural adjustment during the year. This included the interdepartmental workshop in November, 1971, and the setting up of the interdepartmental Committee on Rural Adjustment and the Guidelines Committee to the Rural Assistance Board.

DIVISION OF RESEARCH SERVICES

FUNCTIONS

The Division of Research Services is comprised of four sections:

- Research administration.
- Research station management.
- Architecture.
- Agricultural engineering.

The research administration section comprises the research co-ordinator and his research administration functions, the Directors of Research and their staff at Wagga Agricultural Research Institute, Tamworth Agricultural Research Station and Wollongbar Agricultural Research Station.

The research station management section is responsible for the control and administration of the Wagga Agricultural Research Institute and the Department's research stations with the exception of the Veterinary Research Station, Glenfield and the Cattle Tick Research Station, Wollongbar. The Division is also responsible for the overall supervision of farming activities on the Veterinary Research Station, Glenfield and at the Hawkesbury, Wagga, Orange, and Tocal Agricultural Colleges.

The architect's section is responsible for the organization and implementation of the Department's capital works programme at departmental institutions. It also designs and supervises all maintenance work on research stations and assists college principals in connection with maintenance programmes. It provides a liaison with officers of the Department of Public Works and the Housing Commission and, in addition, supplies plans and advisory information to other authorities and to members of the public.

The agricultural engineering section is responsible for the agricultural engineering extension activities of the Department through its seven agricultural machinery officers located in the various agricultural regions throughout the State. Research work is carried out at the newly established agricultural engineering centre at Glenfield, where prototype machines are made for the agricultural industries and for departmental research officers. This section is also responsible for the purchase and maintenance of all departmental plant, equipment and machinery.

STAFF

Vacancies

The position of senior research officer (wheat genetics) at the Wagga Agricultural Research Institute has been vacant for over 2 years and this has had a significant effect on the institute's activities. The improved recruitment situation appears likely to provide for the filling of this position in the near future.

Retirement and Appointments

Mr N. K. Golding, formerly Chief, Division of Research Stations retired in September, 1971, at which time the position was re-designated, Chief, Division of Research Services and Mr K. E. Hutton, formerly Research Co-ordinator, was appointed. Mr R. J. Jessup, formerly Executive Assistant to the Senior Deputy Director-General was appointed to the position of Research Co-ordinator.

Norman Kenneth (Ken) Golding was first employed as a Veterinary Inspector with the Pilliga Pastures Protection Board on 1st March, 1937. He joined the Department on 26th January, 1940, and served as a Veterinary Officer in various posts until his appointment as District Veterinary Officer, Cootamundra later in 1947. In November, 1951 Mr Golding was transferred to a senior veterinary position in Sydney and served there until he became Deputy Chief, Division of Animal Industry in April, 1965. In September, 1966, he was appointed Chief, Division of Research Stations, the position he held when he retired. He was known throughout the State as a capable veterinarian, having had particular association with such important activities as the tuberculosis eradication scheme, the introduction of the Cattle Compensation Act, the conditions for entry of stock from Queensland into New South Wales and pullorum disease control. As an administrator Mr Golding was held in high regard for his sound judgment and advice and for his loyalty and dedication to the interests of the Service.

Overseas Visit

Dr G. Evans, Research Scientist, Agricultural Research Station, Tamworth, left for overseas early in September, 1971. After attending the International Symposium on Verticillium in Kent, United Kingdom, Dr Evans went to Canada for special duties and studies at Harrow Research Station. He is to remain there until October, 1972.

Committees

Some of the more significant committees on which officers of the Division represent the Department are:

- N.S.W. Wheat Research Committee.
- N.S.W. Tobacco Advisory Committee.
- Bush Fire Council of New South Wales.
- Wines Grapes Marketing Board.
- Executive Advisory Committee for Safety in Rural Industries.

Assistance to Overseas Personnel

Personnel from a number of overseas countries have undergone varying periods of from one day to 3 months' training on the Department's research stations during the year under review. Visits have been arranged both in association with the Commonwealth Department of Foreign Affairs and independently and have included personnel from France, India, Ethiopia, South Africa, England, Germany, U.S.A., Korea, Tanzania, Taiwan, New Zealand, and Ceylon.

NEW DEVELOPMENTS

Restructuring of the Division

The former Division of Research Stations has now been changed to the Division of Research Services. Coincident with the change in name two sections, drought relief and public watering places, were transferred to the Division of Animal Industry. At the same time the research co-ordinator's section, formerly attached directly to the Executive has been absorbed into the new Division of Research Services.

Establishment of Regional Research Directorates

Approval has been obtained for the establishment of four regional directorates of research. It is intended that the four directorates will comprise:

- Agricultural Research Station, Tamworth, with associated research stations at Narrabri, Glen Innes, substations at Breeza and Ashford and research agronomists located at Muswellbrook, Maitland, and C.B. Alexander College.
- Agricultural Research Institute, Wagga Wagga, with associated research stations at Temora and Cowra plus the research staff located with the CSIRO Division of Plant Industry, Canberra.
- Agricultural Research Station, Wollongbar, with associated stations at Alstonville and Grafton plus the research agronomists at Taree.
- Agricultural College and Research Station, Yanco, with associated stations at Leeton and Griffith and Dareton together with the demonstration orchard at Cudgel and other research staff located within the area.

PRODUCTION AND LIVESTOCK

Production during the year at research stations administered by the Division was: winter cereals 25,181 bus; grain sorghum 29,106 bus; maize 2,520 bus; hay 1,069 tons; silage 235 tons; cotton 47,800 lb; soya beans 714 bus; tobacco leaf 1,600 lb; sunflower 15 tons; potatoes 8 tons; sweet potatoes 33 cartons; lambs 1,903 head; wool 101,992 lb; eggs 43,000 doz.; apples 16,348 bus; pears 714 bus; peaches 1,331 bus; nectarines 9 bus; plums 45 bus; prunes 3,020 lb; gordos 6,249 lb; other grapes 116 tons; sultanas 14,986 lb; pecan nuts 254 lb; bananas 10,971 cartons; avocados 396 cartons; citrus 15,521 bus; nursery trees 29,890 trees; nursery fruit for seed 85 bus; horticultural bud production 29,535 buds.

Stock numbers at 30th June, 1972, at research stations administered by the Division were: cattle 2,745; horses 32; sheep 20,692; pigs 385.

CAPITAL WORKS

The Division administers the capital works (General Loan Fund) programme of the Department. A list of works in progress and/or completed during the year, with expenditure figures, is included in appendix I of this report.

LIBRARY

An agricultural engineering library has been established at the Agricultural Engineering Centre, Glenfield.

Research papers are being collected from overseas. Textbooks are being purchased as finance permits.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

FUNCTIONS

The Royal Botanic Gardens and the National Herbarium of New South Wales provide a broad coverage of advisory information and research services in botany and ornamental horticulture. The Herbarium contains some three-quarters of a million specimens, representing in particular the native and naturalized flora of Australia but also including a considerable collection of the world flora.

Its research activities are directed in particular to the production of a detailed and comprehensive *Flora of New South Wales* but studies are extended where appropriate to wider problems in systematic botany including investigations of breeding systems and chromosomal studies. In the ecological field, a vegetation survey of New South Wales is the major activity.

The Gardens display a wide variety of plants from throughout the world and are currently undergoing gradual redevelopment to fulfil an enlarged educational function in general botany and biology as well as in the horticultural and landscaping spheres. Associated with the Gardens are the Mt Tomah annexe for cool-temperate plants, as well as the Domains and Centennial Park, the functions of which are those of large parks catering for passive recreation, sporting activities, and wildlife conservation.

STAFF

Vacancies

Delays in the release by other Departments of appointees to the positions of herbarium assistant and educational officer (on secondment) caused serious delays in the work for which these officers were required.

Implementation of development and improvement works in the Royal Botanic Gardens and allied areas was also seriously hampered by the continuing difficulty experienced in maintaining gardening staff at full strength. The position of foreman, Outer Domain, which became vacant on 6th September, 1971, could not be filled notwithstanding repeated public advertisements. Temporary staff arrangements have been made pending recruitment to this post.

Losses during the year totalled 116 personnel including 68 resignations.

Severances and Appointments

The resignation of Dr J. S. Beard as Director and Chief Botanist took effect from 16th June, 1972. Dr L. A. S. Johnson, formerly Deputy Chief Botanist, was appointed to this position as from 29th June, 1972.

Mr I. S. Olsen, Landscape Designer, resigned on 13th April, 1972. Mr A. J. Tillsley, formerly Chief Propagator, was promoted to fill the vacancy.

During the year three new positions of ranger, Royal Botanic Gardens and Domains, were created to replace four positions of part-time watchmen. Improved security and efficiency is expected to follow appointments to these posts.

Overseas Visits

Following a private visit to Europe and the United Kingdom, Dr Johnson (then Deputy Chief Botanist) spent a week on duty in London, chiefly at the Royal Botanic Gardens, Kew, and at the British Museum (Natural History). He checked type and other important collections relevant to current projects at the National Herbarium, inspected scanning electron microscope installations and held useful discussions with Dr J. Heslop-Harrison (the Director of Kew) and with other scientists and administrators at Kew and the British Museum.

The Superintendent, Royal Botanic Gardens, Mr W. R. Watson, returned to duty after some 4 months' absence overseas following his award of a Public Service Board Fellowship to study administration and development of botanic gardens and kindred institutions in U.S.A., Canada, and Europe. In Europe he attended the International Federation of Parks and Recreation Administration Congress at Rotterdam and chaired the session "Man in Open Space".

Committees and other Bodies

A working group concerned with the deterioration of Norfolk Island pines on metropolitan beaches was set up by the Premier under the chairmanship of the former Director, Dr J. S. Beard and is continuing under the present Director. This group embraces representatives from a number of government departments as well as from universities and local government bodies. A preliminary report has been prepared and forwarded to the Premier.

In March, 1972, Dr L. A. S. Johnson completed his second term as President of the Linnean Society of New South Wales. He also continued to serve on the Parks and Reserves Scientific Committee advising the Minister for Lands, and was appointed to a standing committee convened by the Australian Academy of Science to initiate and supervise work towards a new Flora of Australia.

The Director and the Superintendent, Royal Botanic Gardens (Mr W. R. Watson), were appointed to the organizing committee for the 20th International Horticultural Congress proposed to be held in Sydney during Spring 1978.

Assistance to Overseas Personnel

During the visit of the Soviet oceanographic research vessel *Dmitri Mendeleev* to Sydney, Mr A. Rodd (Horticultural Botanist) was invited by Professor A. L. Takhtajan to accompany him on the ship to Lord Howe Island, the next port of call. While on the island Mr Rodd acted as botanical guide to the Soviet scientific party.

Mr M. A. Ibrahim of the Rural Development Department, Sudan, worked for a short period in the Herbarium to gain experience in botany with reference to his future work.

Mr Wong Wine Yuen, the third Hong Kong fellow placed at the Royal Botanic Gardens completed his second period of 12 months intensive horticultural training. He gained the Horticulture Certificate from the Ryde School of Horticulture and returned to Hong Kong in February, 1972.

Messrs Yueng Wai-Kwong and Woo Wing-Kui, fellows who had received similar training during the period 1969-71 and completed their various technical studies, have in consequence been appointed to higher posts within their homeland organization.

Many notable visitors from overseas were assisted in their investigations by consultations with botanical and horticultural staff and/or by the granting of study facilities.

NEW DEVELOPMENTS

A policy is being developed of increased educational function by the Royal Botanic Gardens. It is expected that this will be developed during the next financial year.

SPECIMEN STORAGE PROBLEMS

The overcrowding of both the specimen storage areas and working space in the National Herbarium is becoming increasingly acute. In contrast to other States, where major herbaria have been provided with modern buildings, our officers are housed in extremely cramped and inadequate conditions. Many activities which should be undertaken cannot be started under present arrangements and these conditions reduce the efficiency of work in progress. The conditions also prevent the specimen collections, which are of the greatest scientific value, being given adequate care and safe storage.

In December, 1971, the Herbarium's collections of fungal specimens were sent on permanent loan to the Biology Branch at Rydalmere. However, the space formerly occupied by these collections is very small in relation to the overcrowding of the remainder of the Herbarium so this provides only very limited relief.

The entire Herbarium collections, totalling over 20,000 boxes, were re-arranged to allow for expansion which has taken place in the collections from Australian sources. Due to the limitations of the present building, large sections of the non-Australian and cryptogamic collections remain very difficult of access or even unavailable for normal consultation. Nevertheless, the re-arrangement has enabled the most frequently consulted section, the Australian material, to be used more readily. This section has expanded about 25 per cent during the past 7 years and the present improvement only very temporarily alleviates the severely overcrowded situation.

Seed stocks for exchange were transferred to a former air raid shelter, which provides only makeshift accommodation but does allow the desirable separation of these stocks from the herbarium storage area.

LIVESTOCK

Two departmentally bred Arab geldings are used at Centennial Park by rangers in the performance of their routine park patrol duties.

LIBRARY

New material totalled 1,942 items (123 books, 1,187 issues of periodicals, 626 pamphlets and reprints, 6 boxes of microfiche cards, and sundry maps and trade publications). Five hundred and forty-two items were catalogued, and 896 periodical articles were indexed. Twenty-five books were donated to the library. Loans to members of staff totalled 1,293; interlibrary loans totalled 249.

AGRICULTURAL EDUCATION SECRETARIAT

FUNCTIONS

The Agricultural Education Secretariat was established in 1970 to co-ordinate the functions, operations, and the administration of the Hawkesbury, Wagga, Orange, Yanco, and C.B. Alexander Agricultural Colleges.

The Secretariat is charged with:

- integration of agricultural education with other functions of the Department;
- formulation of policy and plans for new and improved developments in agricultural education; and
- processing decisions and recommendations from the Committee of Advice on Rural Studies and from the Advanced Education Board.

Control is exercised over expenditure of funds provided by State and Commonwealth for capital works projects for the construction of new buildings and educational facilities at agricultural colleges. The allocation and review of expenditure of moneys provided for maintenance and operating expenses provided from Consolidated Revenue is undertaken also.

Purchase of books and periodicals throughout the Department are co-ordinated by the Secretariat. It also processes applications for college enrolments.

STAFF

Appointments

Dr F. G. Swain as Principal, Hawkesbury Agricultural College.

Dr R. A. Fraser as Senior Lecturer, Hawkesbury Agricultural College.

Mr D. L. Glastonbury as Senior Lecturer, Wagga Agricultural College.

Retirements and Resignation

Mr B. Doman, Principal, Hawkesbury Agricultural College—retired.

Mr K. Rhodes, Senior Lecturer, Hawkesbury Agricultural College—resigned.

Mr C. M. Huie, Field Assistant retired after 40 years of faithful service at Yanco Agricultural College and Research Station.

Bernard (Dick) Doman over a period of more than 43 years service in the Department made significant contributions to agricultural education, agriculture and the rural industries generally. He obtained his degree in agricultural science as a trainee and in 1932 was appointed as a plant breeder. In August, 1937, Mr Doman transferred to the position of lecturer at Hawkesbury Agricultural College. After a short period as Manager of Wagga Experiment Farm at the end of 1948 he became the first Principal of Wagga Agricultural College when the college commenced in March, 1949. When the position of Principal at Hawkesbury became vacant late in 1961 Mr Doman accepted appointment to that post. The marked development of agricultural education in the latter years of his service allowed strong evidence to be seen of the sound judgment and dedication of Mr Doman. His long service will be remembered with affection and respect.

New Position

Mr J. A. Jamieson was appointed to a newly-created position of Budget Control Officer in the Secretariat. The position was established to provide assistance for the Executive Officer in the maintenance of records on capital works and recurrent expenditure in respect of agricultural colleges.

Vacancy

The position of manager, farm operations Hawkesbury Agricultural College has remained vacant throughout the year. The status of the position has been under review by the Public Service Board.

Overseas Visit

Dr R. R. Storrier, Senior Lecturer, Wagga Agricultural College returned to duty from his overseas visit. During his absence of over 4 months Dr Storrier investigated the development and evaluation of methods of measuring inorganic nitrogen in the soil. These investigations were made in the United States, Canada, England, and the Netherlands.

Committees

The Executive Officer (Mr J. E. Jessup) is a member of the C.B. Alexander Foundation and Dr F. G. Swain, Principal, Hawkesbury Agricultural College is a member of the Farrer Memorial Trust. Both are members of the Committee of Advice on Rural Studies.

LIBRARY ACTIVITIES

The Secretariat assumed responsibility for the expenditure of funds allocated for purchase of books and periodicals throughout the Department. A detailed report of the central library activities is given in section 2 of this report, under the heading of "Central Administration".

PRODUCTION AND LIVESTOCK

Information on these is included in the separate report of the Secretariat under section 5.

3.1 RESEARCH ADMINISTRATION

RESEARCH STAFF

The Department has a research staff of approximately 360 scientists in ten Divisions and Branches concerned with particular agricultural industries and research disciplines. Research staff are at both central and regional locations and their duties include aspects of extension and regulatory activities in addition to their investigational work on industry problems.

The numbers of staff at the three major central laboratories located in or near the Metropolitan Area:

Biological and Chemical Research Institute, Rydalmere (Research Staff of 80).

Royal Botanic Gardens and National Herbarium (16).

Glenfield Veterinary Research Station (27).

In addition there are twenty-eight research staff at seven minor central laboratories. Other research staff located in Sydney include fourteen biometricians and seventeen economists. There are also eleven scientists of the Department seconded to five CSIRO laboratories located in Canberra, Sydney, and Brisbane.

The State's requirement for regional research in agriculture is met by four strategically placed centres, Wollongbar Agricultural Research Station, Tamworth Agricultural Research Station, Wagga Wagga Agricultural Research Institute, and Yanco Agricultural College and Research Station, with a total research staffing of eighty-five graduates. A further seventy scientists are based on seventeen associated stations and substations of smaller size with a more specialized interest in certain areas of horticultural, plant and animal production. To increase the coverage of regional problems, six research agronomists are engaged in adaptive research with pastures and crops from an additional five regional locations.

With problems of animal disease control, the central laboratory at Glenfield is assisted by four regional centres with a total research staffing of seventeen. In the same way the central economics research is enhanced by the work of a further eighteen economists located at nine regional centres.

TRAINING OF SCIENTIFIC STAFF

In-service training for both younger and more experienced officers is provided in a number of ways. Five research agronomists from the Division of Plant Industry completed 3-year training programmes with the CSIRO Divisions of Plant Industry and Animal Physiology, as part of the co-operative research work between the two organizations. A conference of research agronomists was attended by all officers engaged in pasture research and by several research officers from other Divisions. Similarly, the Division of Animal Industry provided courses and schools for its officers to enable them to become more closely acquainted with latest research techniques and knowledge. Courses in exotic diseases were conducted for field staff and other personnel who would be involved in any outbreak of a new animal disease. Officers from the Biological and Chemical Research Institute attended a number of special courses dealing with such subjects as bio-assay and insecticide resistance techniques, spectroscopy, and gas liquid chromatography.

Research staff attended a number of technical conferences. The most important were the Australiawide conferences convened to discuss latest research in particular disciplines under the auspices of the Australian Agricultural Council. Officers who attended circulated reports to other research personnel of the Department.

The most significant aspect of training of research staff is the number of officers undertaking post-graduate study towards higher degrees. Fifty-three departmental scientists are currently working towards their masters degree by external study at various universities, using their Departmental research projects as a basis. A further thirty officers are studying towards the degree of Ph.D. either at Australian universities or overseas institutions. Each of these officers has been awarded a scholarship funded by either government or industry sources to assist him in undertaking full time study leave. In addition, two officers have been awarded grants to undertake 12 months post-doctoral studies, one in Canada and the other in the United States.

NEW DEVELOPMENTS

The Department has adopted a programme to decentralize its research activities. Four regional centres of research have been proposed, each to be headed by a Regional Director of Research. The four centres and their associated research stations are:

Agricultural Research Institute, Wagga Wagga (with associated Research Stations, Temora and Cowra).

Agricultural Research Station, Tamworth (with associated Research Stations, Narrabri and Glen Innes).

Agricultural Research Station, Wollongbar (with associated Research Stations, Grafton and Alstonville).

Agricultural College and Research Station, Yanco (with associated Research Stations, Leeton, Griffith, and Dareton).

A Director of Research will be appointed on the associated research stations with sufficient research staff and a Supervisor of Research will exercise local control on certain of the smaller Stations. Directors and Regional Directors of Research will be responsible to the Chief, Division of Research Services, the new Division which has replaced the Division of Research Stations.

Because of the dynamic nature of the agricultural industries, it has been necessary to change the direction of research in many areas. In the Division of Plant Industry much greater emphasis is being placed on research into the production of oil and protein crops, particularly rapeseed, soybeans, sunflowers, and lupins. It is estimated that the equivalent of ten research agronomists are now concerned with these investigations, leading to reduction in some aspects of pasture and crop production research. In the Division of Horticulture, the intensification of investigations associated with increasing orchard planting densities has led to a change in direction of the Division's overall research programme. A specific development of note from this Division has been the establishment of wine making research facilities at the Griffith Viticultural Research Station.

The most notable change occurring in biological research has been the expansion of research into the biological and ecological control of soilborne plant pathogens. To assist in this work a new laboratory has been provided by the Rural Credits Development Fund. In the field of entomology, increasing emphasis is being placed on the development of the integrated pest control concept as the basis for the Department's approach to insect pest problems. To further this research a new section has been created within the Entomology Branch which is investigating new approaches, largely non-chemical, to insect control. Initial investigations have been directed at the physiological responses associated with insect behaviour.

In the Royal Botanic Gardens, a new development of note has been the initial investigations of the ultrastructure and anatomy of the Gramineae and related families. This research brings a new approach to bear on questions of relationships and evolution which are highly relevant to the systematic studies of the Australian flora. The work on ultrastructure is a co-operative venture with the University of Sydney, requiring as it does, the use of facilities such as the electron microscope.

RESEARCH COMMITTEES

As detailed in section 2 (Administration) of this report, substantial funds for the conduct of research are granted by various industry research funds and other organizations such as the Reserve Bank. The research conducted with the assistance of outside funds is reviewed annually by departmental committees composed of senior research personnel of the Divisions, institutes and stations concerned. In addition each major project is examined individually throughout the year.

There are also numerous advisory committees which have been established with the aim of assisting the Department in allocating its research effort to best effect. These committees enable the Department to keep in very close touch with the production problems of each industry. One of the most influential of these committees is the recently established Minister's Advisory Committee on Research in Agriculture, which is composed of representatives from CSIRO and universities, and has the task of advising the Minister on recommended new fields of agricultural research. Two other committees which have particular reference to the wheat industry of the State, the State Wheat Improvement Committee and the Departmental Wheat Executive, meet annually to establish priorities for the wheat research being conducted in New South Wales.

VISITORS

During the year the Department has been visited by many interstate and overseas representatives of Departments of Agriculture, universities and other institutions. In a number of cases, scientists from overseas institutions have spent a period of some weeks working with research officers of this Department. Dr T. A. Toussoun, Director of the Institute for Fungus Research, San Francisco, spent some time working with plant pathologists of this Department on particular aspects of research into diseases caused by the fungus *Fusarium*. Dr K. F. Baker, Supervisor of Plant Pathology at the University of California, spent a period of six months in the Biology Branch working with the Department's soil microbiology group on the biological and ecological control of soil-borne diseases.

3.2 RESEARCH ACTIVITIES

HORTICULTURE AND HORTICULTURAL PRODUCTS

STONE FRUITS

Variety Introductions, Selection and Testing

The perishability of stone fruits renders it necessary to have a succession of varieties maturing at different times to maintain supplies of fruit over the whole season, thus selection and testing of varieties continues to be given prominence in the research programme.

The evaluation of over 100 varieties of canning and dessert fruits continued on research stations and in district trial plots in addition to observations on characteristics of numerous breeding selections. Twenty varieties showing little promise were discarded while the testing of others has been discontinued on acceptance by the industry.

Selection and testing of clonal strains of important peach and prune varieties is now receiving attention and a project has been initiated to produce virus tested clones of all major varieties.

Two local canning peach selections and recently imported early yellow fleshed dessert peaches and yellow fleshed nectarines are being widely used in commercial areas. Other promising material is being introduced from overseas.

Root Stock Evaluation

Plum rootstocks, regarded as more resistant to waterlogging, are being examined in a trial with dessert peaches at Bathurst where it has been demonstrated that the selections used are unsuitable, having produced trees of poor vigour with a high tendency to suckering.

In recently established trials, three commonly used peach seedlings rootstocks, Pullars, Golden Queen, and Elberta, are being compared with Nemaguard and Okinawa seedlings, two varieties being used overseas. Growth differences have so far been insignificant.

In a rootstock evaluation trial for apricots at Yanco Agricultural Research Station, trees on buck plum have made more vigorous growth and commenced to crop earlier than those on apricot seedling.

Irrigation

Trials with trickle irrigation on peaches at Bathurst A.R.S. and Yanco A.R.S. demonstrated the need for determination of soil moisture status as a guide to frequency of application and quantity of water required. Irrigation applications using a crop factor based only on evaporimeter readings resulted in over watering and death of trees at Bathurst A.R.S. and under watering for part of the season at Yanco A.R.S. If evaporimeter readings are to be used commercially, they must be adjusted for rainfall, soil type and variation in the tree's requirements over the season.

Nutritional Studies

Studies continued to establish leaf nutrient level standards and sampling procedures for peaches, apricots, sweet cherries, and plums. These standards will be used extensively as a guide in the Department's diagnostic service to the grower.

Additionally, studies were undertaken into means of improving absorption of foliar applied nutrients to stone fruit trees.

Weed Control

In herbicide trials at Bathurst A.R.S., an application along tree rows of 2 lb terbacil plus 1 lb diuron per sprayed acre gave season long weed control with no phytotoxic damage to trees. Terbacil applications to prunes produced phytotoxic symptoms in the trees but despite this, the affected trees made better growth by the end of the season than those under other treatments where weed control was not so complete.

Crop Regulation

Fruit sizing studies using various methods of crop control, have continued. In chemical thinning trials, promising results were obtained with Golden Queen peaches using the growth regulating chemicals 3CPA and ethephon, but the work must be repeated to establish whether the results can be maintained over a number of seasons.

Mechanical Harvesting

Initial investigations into horticultural problems associated with the mechanical harvesting of processing fruits have been commenced at Yanco A.R.S. Peaches and prunes are being trained to various forms which will be studied in relation to adaptability for mechanical harvesting, completeness of fruit removal, damage to the mechanically harvested fruit, evenness of maturity and the quality and uniformity of fruit harvested.

Recent trials with Alar and ethephon applications to peaches, prunes, and apricots have demonstrated that fruit maturity can be advanced with these chemicals. However, more extensive investigations are needed to examine their effects on evenness of maturity obtained in comparison with untreated trees and to determine the influence of treatments on cropping and fruit quality.

Post Harvest Problems

Investigations were continued at Bathurst A.R.S. with emphasis on problems associated with the commercial application of fungicidal dip mixtures that have successfully controlled brown and transit post harvest rots in small scale trials.

Using benomyl and thiophanate-methyl studies showed that:

- the duration of dipping is unimportant providing that fruit is thoroughly wet;
- a slight delay between harvesting and dipping is unimportant;
- there was no increase in rotting where the fruit was held up to 48 hours at either ambient temperatures or in a cool room before dipping;
- dips held for a period up to 8 days improved in efficacy indicating that the breakdown product produced on hydrolysis is a more effective fungicide than the manufactured material.

In a commercial scale trial, analysis of the dip solution indicated that 65 gallons of a 500 p.p.m. benomyl suspension remained stable for the dipping of 1,000 cases of peaches over a period of one week.

Further studies conducted into the breakdown of Murrumbidgee Irrigation Area apricots in cans again demonstrated that the condition can be induced with an infection of *Rhizopus stolonifer* on fresh fruit, but why the condition does not occur in Victorian (Goulburn Valley) fruit has not been resolved.

Biological Studies

Brown rot continues to receive priority in stone fruit disease control investigations. Substantial progress has been made in the past 3 years with the use of the penetrant fungicide, Benomyl, and in association with the Bureau of Meteorology a unique brown rot forecasting service has been introduced in the M.I.A. During the past year several new fungicides have been evaluated, one of which (Cela compound W 524) appears to be particularly effective.

The research programme was extended to determine effective spray schedules for brown rot control in prunes and cherries at Young, and studies into the tolerance to Benomyl of the causal organism, *Sclerotinia fructicola*, were conducted at the Biological and Chemical Research Institute, Rydalmere.

Studies continued into the identification, incidence, and significance of various virus diseases on peaches, apricots, and cherries. Biochemical aspects of bud shedding in peaches are being investigated and the possibility of bud shedding being due to viruses or genetical causes is being examined.

Further investigations include studies on root rots of deciduous fruits, peach replant problems, prune decline, and bacterial canker in cherries. Spore trapping observations have been commenced of the stone-fruit rust fungus.

Entomological Study

Activity of oriental fruit moth (*Cydia molesta*) was monitored in the M.I.A. and a weekly advisory service of moth activity was provided to horticultural extension officers. Observations were made on the failure of demeton S methyl to control green peach aphids, *Myzus persicae*, and alternative spray materials were tested.

POME FRUITS

Cultural Practices

Planting density.—With the objective of inducing earlier bearing and achieving more efficient production several aspects relating to planting density are being examined in six trials at the Orange and Bathurst Agricultural Research Stations, and three in the Batlow and Orange districts. These include trials of semi-dwarfing rootstocks, planting densities ranging from 174 to 363 trees per acre and four tree training systems.

In an apple tree spacing trial at Orange A.R.S., which is now five years old, there is no difference at this stage in yield of trees planted at 13 ft apart in the row and those planted 6 ft 6 in apart. In effect the most intensively planted trees are yielding twice as much fruit per acre as the more widely spaced trees.

Rootstock recommendations.—Arising from rootstock trials in progress tentative rootstock recommendations were issued for the major apple varieties grown. At this stage rootstock MM106 is a good performer under a wide range of conditions. M793 though not tested as widely as MM106 has shown considerable promise as a rootstock at Bathurst A.R.S., particularly for Jonathan.

Irrigation.—A trial at Bathurst A.R.S. which examines some aspects of trickle irrigation in a supplementary irrigation situation, has shown that water applications based on 20, 30, and 40 per cent of evaporation loss from a standard evaporation pan, have all increased yields when compared to a non-irrigated treatment. Optimum application rates have yet to be determined but because the measurement of evaporation loss from an open pan has not accurately reflected soil moisture status, it is proposed that future treatments will be based on soil moisture readings (tensiometers).

Nutrition.—The commercially promoted practice of incorporating fertilizer in the tree hole at the time of planting apple trees has been examined. After two seasons only one fertilizer mixture, of six examined, when used at a low-rate has increased tree growth. Others were not different to untreated, whilst some actually injured the young trees and depressed growth. It was considered that the practice could be risky and could not be recommended.

Herbicides.—Four chemical herbicides have been incorporated in trials at Bathurst A.R.S. on both mature and young apple trees at rates up to four times greater than normally recommended to establish any long-term phytotoxic effects. At the heaviest application rates diuron accumulated sufficiently to cause considerable injury by the fourth season after application. However, no injury has occurred where the herbicides have been used at recommended rates.

Tree growth and cropping of young apples has been stimulated following application of Simazine.

In a separate trial the susceptibility of Josephine pear to terbacil has been demonstrated.

Economic aspects of management.—Several trials, especially the tree training and planting density trials at Orange A.R.S., are being closely monitored for costs of establishment, maintenance, harvesting, etc. in relation to gross returns. Cost benefit analysis of all new management and cultural techniques developed are an important part of final treatment evaluations.

Investigations with Growth Regulatory Substances

Maturity regulation.—With the objective of prolonging the effective harvesting period of apples by delaying maturity, significant progress has been achieved by application of the chemicals Alar and Ethrel. This work could lead to an improvement in quality of apples marketed.

Crop thinning.—Initial investigations on the chemical thinning of pears was commenced, very good results being achieved with post-blossom sprays of naphthalene acetic acid and naphthalene acetamide. Effective thinning of Gravenstein apples has also been achieved with post-blossom sprays of N.A.A.

Propagation

Work is being undertaken to find a less expensive method than layering of propagating certain apple rootstocks. Emphasis is being given to examination of rooting of hardwood cuttings. Further refinements were introduced during the year and additional success achieved. Rooting was increased 70-85 per cent with rootstock MM106, 30-75 per cent with MM102, 47-75 per cent with MM110 and 1-10 per cent with Northern Spy. The results, with the exception of Northern Spy, suggest the feasibility of commercial adaptation of this technique.

Pest and Disease Control

Integrated control and pest management.—This concept of pest control which utilizes all suitable techniques including chemical and non-chemical control practices is being examined in four States. At the Bathurst A.R.S. the effectiveness of reduced strength insecticide for codling moth control and the related effect of this on populations of both the troublesome two-spotted mite and light brown apple moth and beneficial insects were examined. Control of codling moth with an approximate half strength insecticide did not significantly increase infestations.

Related work has included the examination of suitable alternatives to DDT (which is deleterious to beneficial orchard fauna) for control of plague thrips, examination of the habits of dimpling bug during the period of fruit susceptibility and studies of predaceous mite species to determine their importance in control of the two-spotted mite.

Field pest investigations.—Control of two-spotted mite has been given particular attention. After a few seasons continued use, a miticide's efficacy decreases. It is thus important to continually evaluate new miticides. This year, three new miticides were proved to be effective.

Control of San Jose scale on pears in the M.I.A. has been improved by using a two spray programme of methidathion at 0.05 per cent without oil in spring and summer.

Laboratory pest investigations.—Laboratory culturing of two species of mites, predators of two-spotted mite, was undertaken at the B.C.R.I., Rydalmere.

Initial work has been successfully carried out to develop a monitoring system which can detect resistance of two-spotted mite to commercially used miticides.

Work is in progress to establish the susceptibility of codling moth to currently used chemicals for future determinations of resistance and for screening of new chemicals. Large numbers of codling moth have been produced in the laboratory.

A recent Canadian requirement has necessitated apple disinfection investigations against light brown apple moth. Methyl bromide fumigation and cool storage treatments examined to date at Gosford show that it should now be possible to meet the Canadian requirements.

Disease control.—Work undertaken in respect of the three major diseases, apple and pear scab and powdery mildew, has resulted in the setting up of an apple and pear scab forecasting service in the M.I.A. New recommendations for mildew control will be issued in the near future.

Fruit Storage

Controlled atmosphere storage.—Final work on the development of an economical controlled atmosphere storage system was completed. Three stores of an improved design which provide for a better working floor and pre-cooling of fruit within the plastic tent storage chamber were brought into commercial use. About 60,000 bushels of apples are currently cool stored in N.S.W. by means of this system.

Storage disorders.—Studies of physiological disorders of apples which are the major causes of wastage in cool-stored fruit are being made by injecting metabolites into the fruit at commencement of storage. Several compounds have been found to increase low temperature breakdown and one, gibberellic acid, has appreciably reduced the problem.

CITRUS FRUITS

Rind Blemish Investigations

Citrus rind blemish incidence and severity increases rapidly during the first 12 weeks after fruit set at Gosford. Wind causing the abrasion of fruitlets on twigs and leaf blades is the most important casual factor.

An artificial windbreak, consisting of an 18-foot high polypropylene mesh barrier erected in a mature citrus orchard at Mangrove Mountain, reduced wind force by up to 70 per cent in the immediate lee and up to 20 per cent six rows away. The improved growing conditions in this coastal climate would be further enhanced by the increased maximum temperatures recorded in the protected area. Artificial windbreaks can be immediately established, offer no tree competition and have a number of other advantages over natural windbreaks.

A summation of prevailing wind data for 3 months following fruit set, showed that the majority of damaging winds had a westerly origin. Data of this nature are important for determining the most effective design for a given situation.

Post Harvest Wastage

At the Gosford Citrus Wastage Research Laboratory, methods have been examined for bulk dipping of oranges for control of green mould (*Penicillium digitatum*) wastage when fruit is held pending normal treatment at packing. Appropriate equipment was designed for dipping of bins on receipt with an approved fungicide. Residue level investigations showed that bulk dipping at 500 p.p.m. with thiobendazole followed by normal flood application in the packing line at 1,000 p.p.m. caused only slight increases in final residue when compared with the single packing line treatment. Effectiveness of this holding treatment depends on prompt treatment after harvest. Advantage of this technique has already been taken by sections of the industry.

Despite reports from other states and overseas, that an increase in incidence of *Alternaria* centre rot has been associated with the use of thiobendazole, no such relationship could be established in trials at Gosford with Valencia oranges this season. However, dipping in gibberellic acid and 2,4-D appeared promising for control of the disorder.

Quality and Crop Control

Abscission chemicals to aid harvesting.—Preliminary trials at Dareton Horticultural Research Station and Somersby showed that the pull force necessary to remove mature Valencia oranges from the tree was reduced by about 50 per cent within a week of spray applications of cycloheximide. The inclusion of polyethylene emulsion further reduced the pull force. Such a method shows promise for harvesting of fruit for processing and is basic to the development of mechanical harvesting techniques.

Late hanging quality of grapefruit.—Gibberellic acid sprays applied to Marsh grapefruit, retained fruit in a more juvenile condition, delaying peak maturity and subsequent quality decline. Applications up to mid July appeared to be the most promising. Green rind spotting associated with cold injury could be a problem in some seasons, but treatment should give better quality with late harvested fruit.

Citrus juice quality investigations.—At Yanco A.R.S., tests of consumer acceptability of Valencias for late marketing showed that juice and segments became less acceptable as the season progressed, although juice from propagations on trifoliate orange and Carrizo rootstocks were acceptable until May, while propagations on rough lemon and sweet orange were considered unacceptable after February. Acceptability ratings were positively correlated with sugar content and in the case of segments with percentage juice.

Effects of mandarin harvesting times.—Over six seasons, three harvesting regimes did not affect the yield of Ellendale mandarins at Dareton H.R.S. Fortnightly pickovers for size, resulted in very little increase in the size of remaining fruit. Despite slight advantages in gross return from selective picking in some years, additional costs would offset this. Progressive complete tree harvests would have been equally effective.

Tree management.—In a trial at Yanco A.R.S., navel and Valencia trees dwarfed by inoculation with buds from selected dwarfing clones have been satisfactory for high density plantings on trifoliate orange rootstock. One clone, carrying the scaling and other symptoms of the exocortis virus was the most dwarfed, but recent research has shown that the clones carrying the dwarfing factor only are more promising for this use, because they do not suffer from butt scaling and periodic unthriftness. Four of these budlines in the trial have given a similarly good result at 350 trees per acre, and their performance has been the basis for a dwarf citrus spacing trial to be planted in 1973.

Tree spacing and hedging.—At Dareton H.R.S., cropping over 8 years has shown that production per acre from double planted Valencias, has continued to be considerably higher than from normally spaced trees but the percentage yield difference is decreasing.

A truncate triangular form of hedging in double planted trees at Dareton H.R.S. partially modified the alternate bearing habit, while at Yanco A.R.S., a similar treatment reversed the bearing pattern. Severe rectangular hedging to a width of 6 feet stimulated excessive vegetative growth particularly at Dareton H.R.S. A correct balance between tree vigour, severity of pruning and time of pruning appears to be necessary for satisfactory results with hedging.

Citrus Improvement

Rootstock/scion incompatibility.—Ring grafting techniques with seedlings have confirmed that Eureka lemon/trifoliata incompatibility can be forecast microscopically from butt union anatomy studies after 6–7 months. By 10 months abnormalities were detected microscopically. Rapid evaluation of the compatibility of lemon rootstocks will now be possible and eliminate reliance on the observation of slowly developing field symptoms.

Alternative lemon varieties and rootstocks.—An alternative to the common lemon rootstock is required for planting lemons on coastal districts where phytophthora root and collar rots are a problem. Although *Poncirus trifoliata* is suitable for most species, it is not compatible with the favoured Eureka lemon.

A number of imported rough lemon selections have been introduced and tested for phytophthora tolerance at the B.C.R.I., Rydalmere. Three red rough lemon selections have been included in a new lemon rootstock trial now being propagated for Somersby. Another trial has already been planted at Somersby with a range of varieties and rootstocks to select an alternative to the Eureka/rough lemon combination.

Citrus virus indexing.—Screening of citrus for the bud-transmitted virus diseases xyloporosis, psorosis, and exocortis was continued at the B.C.R.I., Rydalmere. Candidates indexed as free of these viruses will now be available for inclusion as foundation trees in the National Citrus Repository to be established at Dareton H.R.S.

Screening for myco-plasma.—The myco-plasma caused diseases of greening, dieback, leaf mottle, and stubborn have not been recorded in Australia. Greening is the most serious disease of citrus in South East Asia, India, and Africa and occasionally symptoms suggestive of it have been seen in Australia. Fortunately, attempted transmissions from suspect trees have not been successful. In addition, examinations by electron microscope have failed to reveal any myco-plasma like organisms.

Pest and Disease Control

In further screening for chemicals to control red scale, early (December) applications of methidathion gave outstanding results. For control of white wax scale, methidathion also gave promising results both at normal December timing and during February when other scaleicides are ineffective.

Study on the influence of recommended scaleicides on the chalcidoid wasp predators of red scale were continued. The aim is to assess these natural scale enemies in combination with the optimal combinations of insecticides and application timing for commercial control.

The recommendation for black spot control with mezineb has been readily accepted and has resulted in improved quality of coastal Valencias. Recent research showed that benomyl was even more outstanding as a curative-systemic application for black spot and minimised the number of sprays required. This field treatment was also most effective in the control of post harvest mould decay.

For treatment of coastal melanose, copper oxychloride, tribasic copper sulphate, and cuprous oxide were equally effective, while Daconil and benomyl were relatively ineffective.

TROPICAL FRUIT

Breeding and Selection—Papaws

Papaw production is limited by the lack of suitable types. Preliminary selections of male and female parent trees with suitable characteristics are now being made in a breeding programme which has been commenced at Alstonville Tropical Fruit Research Station. Skin and flesh colour, depth, firmness, flavour, and texture of flesh are being considered.

Nutrition—Bananas

Potash, magnesium, and manganese.—This long term study commenced at Alstonville Tropical Fruit Research Station in 1970 is examining the effects of deficient levels of potash and magnesium in relation to growth, yield and leaf nutrient in the presence of normal and toxic levels of manganese. Using sand culture techniques, nutrients are applied in solution and irrigation schedules are designed to minimize leaching.

Initial results indicate that the banana plant is an efficient user of nitrogen and potash and that the fruit removes the greatest proportion of nitrogen, phosphorus, and potash. Other indications are that calcium, magnesium, and manganese are recycled in leaf trash, and that copper, zinc, and potash are in greater proportion than other elements in the growing plant. Increasing levels of potash, magnesium, manganese increased yields with potash having the most marked effect.

Decline of organic and mineral reserves in spent pseudostems.—Investigations at Alstonville T.F.R.S. have shown that significant losses of dry matter, potash, nitrogen, calcium, manganese, and copper occurred from the lower one metre of the pseudostem after harvest.

Further work is needed to determine the fate of the lost elements, the effect of time of removal of pseudostems on sucker growth and yield, and the influence of seasonal conditions and nutrient supply on translocation from pseudostems.

Irrigation

Sprinkler irrigation—bananas.—At Alstonville T.F.R.S., the long term effects on bananas of sprinkler irrigation are being studied. Four levels of available water capacity were maintained. The high level treatment resulted in highest fruit weight and hand/finger numbers, although two high rainfall years in succession have lessened these differences. A moisture release curve is being prepared in relation to the moisture holding capacity of the particular soil in the trial.

Trickle irrigation—bananas and macadamias.—Trickle irrigation studies with bananas and macadamia nuts have recently been commenced at Alstonville T.F.R.S. and Dunoon respectively. Various water application rates are being studied for their effects on growth and yield in order to determine satisfactory regimes for this form of supplementary irrigation.

Crop Control

Cincturing avocados.—Increased fruit set following cincturing (girdling or ringing) of limbs on some avocado varieties has been reported from overseas. At Alstonville T.F.R.S. a study commenced in 1971 with the Fuerte variety to test this technique. An overall yield increase was achieved with cincturing and 68 per cent of treated limbs produced more fruit. There was no increase in the production of parthenocarpic fruits as claimed by overseas workers.

Maturation

Maturity testing of avocados.—Chemical and physical maturity indices for New South Wales avocados are being developed in studies centred at Wollongbar Agricultural Research Station.

These will be correlated with maturity (consumer acceptability) using taste panels. Non-destructive indices are being examined, but destructive tests such as oil extraction appear to be more reliable. Suitable picking dates, and sampling procedures are also being established.

Plant Protection

Avocado pests.—Observations at Alstonville T.F.R.S. are directed to the behaviour and habits of the monolepta beetle, fruit spotting bug and a small brown leaf beetle in order to complete records of their life history.

Banana pests.—Investigations are being carried out from Alstonville T.F.R.S. testing candidate insecticides to replace dieldrin for the control of the banana weevil borer; developing other techniques which may contribute to the control of the pest and studying the habits and means of spread of the insect. The chemical pirimiphos-ethyl has shown promise and is being further tested for control.

Monitoring for dieldrin resistance was conducted throughout the year by the B.C.R.I., Rydalmere. This work showed resistance has developed in the Brunswick, Tweed, and Richmond districts but to date no resistance has been detected in the Clarence, Nambucca, and Coffs Harbour areas. Bioassay investigations determined that resistance to dieldrin and aldrin is of a high order, and to lindane relatively lower. However, in the latter case it is sufficiently high to limit the use of the compound in the field.

A survey of the incidence and severity of the condition known as corky scab is being undertaken. Evidence to date indicates that bunches emerging in the early summer are subject to damage by flower thrips which results in an unsightly corky scab on the skin when the fruit matures.

Physiological disorders—bananas.—Preliminary investigations into the cause of split corm of bananas, indicate that the gibberellin—producing fungus *Fusarium oxysporum* may be associated with the disorder. Studies have been extended to check a range of soils, to carry out pathogenicity tests and investigate chemical and fungistatic treatments.

Post Harvest Research—Bananas

Maturation studies.—Green life of bananas, the time between harvest and commencement of ripening, has been examined in relation to time of harvest. Indications are that green life is decreased as bunch maturity increases prior to harvest. Fruit is being examined over a range of sampling periods to determine at what point maximum fruit weight can be expected with minimum loss of green life.

Handling and packaging.—Investigations at Alstonville T.F.R.S. in collaboration with the CSIRO Division of Food Research and the University of Sydney, into pre-packaging of bananas in PVC and polyethylene films showed that the permeability of the materials must be such as to allow penetration of ethylene to initiate ripening, exchange of oxygen and carbon dioxide with the atmosphere, and air circulation to provide heat exchange.

Fungicidal treatment of bananas after packing.—Studies to determine the behaviour of benomyl and thiabendazole under commercial conditions demonstrated a low order of stripping of material from dip suspensions and satisfactory biological efficiency when recommended procedures are followed. Thiophanate-methyl, a recent addition to the long list of efficient modern fungicides, has satisfactorily controlled *Colletotrichum musae* (black-end) but has to be used at higher concentrations than benomyl and thiabendazole.

Transport and storage—bananas.—Studies over several years in collaboration with the CSIRO Division of Food Research have shown that ripening of bananas packed in sealed polyethylene bags in cartons is delayed if produced ethylene is absorbed. This has been achieved commercially by placing a potassium permanganate impregnated block within the package.

The removal of ethylene from fruit storage spaces using ultra violet lamps to produce and destroy ozone in a continuous action without exposure of the fruit to injury by the rays is being studied. An ethylene scrubber based on this preliminary work is being developed.

Ripening—Bananas

Studies in banana ripening at Alstonville T.F.R.S. have examined changes in skin colour and pulp firmness at three ripening and three post ripening storage temperatures. Results have shown that increasing ripening temperatures affect speed of ripening (colour change) and reduction in pulp firmness and that increased storage temperatures adversely affected storage life.

A condition of bananas known as “green ripe” (pulp softens without the normal change to yellow skin colour), has been studied in co-operation with the CSIRO Division of Food Research. It has been shown that the condition can be induced when bananas are exposed to ethylene in the presence of low concentrations of oxygen.

GRAPES AND WINE

Vine Variety Improvement

Grapevine improvement is being effected by the introduction of varieties and clones from overseas, selection of high yielding and quality clones from plantings in N.S.W. and elimination of viruses by heat therapy.

The first releases from quarantine of a series of European introductions were made in 1971, but subsequent releases have been limited because the majority of importations have given positive virus index symptoms. These infected clones will now be heat treated before their release.

Local selections of the wine varieties Shiraz, Semillon, and Cabernet Sauvignon are being assessed in field trials at Griffith Viticultural Research Station while selections of the drying varieties Muscat Gordo Blanco and Currant are being assessed at Dareton Horticultural Research Station. The more promising of these are being heat-treated at Rydalmere B.C.R.I. and have been propagated to supply growers as an interim source of improved planting material.

Pruning, Spacing, and Trellising

Analysis of 6 years data from the Shiraz pruning and training trial at Griffith V.R.S. was completed and new treatments to compare four trellis widths, four pruning levels, two pruning methods and the use of foliage wires, have been superimposed over the old trellis.

The Semillon pruning and training trial converted in 1970 to compare four trellis widths and four pruning levels yielded its first crop under the new treatments. While "T" trellis outyielded single wire trellis, there was little difference between width of "T" and pruning levels.

Yields from the first crop from a Shiraz spacing and trellising trial ranged from 24,000 lb/ac for vines planted 5 ft x 5 ft to 13,200 lb/ac for vines planted at 10 ft x 7 ft 6 in and down to 7,500 lb/ac for vines planted at 15 ft x 10 ft.

At Dareton H.R.S. results from a pruning and wrapping trial showed that after 3 years, yields of conventionally pruned and wrapped vines were equal or slightly superior to those with spurs left for replacement cane development and those with canes wrapped down across the crown.

Growth Regulators

Promising results obtained in 1970-71 with a double spraying of gibberellic acid (GA) and Cycocel to counter Cycocel berry size reduction in Cabernet Sauvignon when Cycocel alone is applied, could not be repeated in 1971-2.

GA applied to Waltham Cross vines in separate experiments at Griffith V.R.S. and Dareton H.R.S. in 1970-1 caused leaf distortion, reduced bud burst and produced a substantial reduction in bunch number in the following season. However, at Dareton H.R.S. continued use of GA on sultana over 6 years has induced no phytotoxic symptoms and responses in the form of increased berry size are still being obtained.

Irrigation

Shiraz vines at Griffith, trickle irrigated at a crop factor of 0.4, gave yields similar to normal furrow irrigated vines while yields on vines trickle irrigated at a crop factor of 0.2 yielded only slightly less.

Where the vines were lightly pruned yields from moisture stress treatments were up to 42 per cent less than normally irrigated treatments but under a severe pruning regime which reduced crop levels by 44 per cent, there were only small differences in yield from the various irrigation treatments. Future examination of fruit and wine quality from this trial, will resolve the question of the effect of irrigation and crop level on wine quality.

Trellis Drying

Studies on the new technique of drying sultana grapes on the vine at Dareton showed that canes cut in early and mid-March produced better fruit quality than those cut in late March. Two applications of dip mixtures sprayed onto the bunches proved superior to a single application in terms of both drying rate and fruit quality. Grit content of the trellis dried fruit was extremely low.

Fungus Diseases

After 2 years of a long-term Hunter Valley trial, no differences in vine performance and fruit quality between Shiraz vines treated with four fungicides commonly used in controlling downy mildew, were observed. Several fungicides and a GA treatment have shown promise in reducing the incidence of bunch rot in Semillon.

STRAWBERRIES

A strawberry research project has examined the production of new varieties by selection of seedlings from controlled crosses, and the introduction of imported varieties. Some selections have been very promising.

ORNAMENTALS

The testing of fungicides for the control of azalea petal blight was continued at the Rydalmere B.C.R.I. A trial incorporating benomyl, thiabendazole and thiophanate-methyl was inconclusive because of the low incidence of disease this year.

In a survey of virus diseases of orchids in N.S.W. a disease on *Vanda* producing dark sunken lesions and purple ring-spots was associated with rod-shaped virus particles 600 mu long. This does not conform with known orchid viruses and investigations to determine its identity are continuing.

Phytophthora cinnamomi is a major pathogen in plant nurseries and long-term experiments to study the survival of the pathogen in soil treated with fungicides and untreated soil and to determine effects of forms of soil nitrogen on the fungus, were initiated.

IRRIGATION AND DRAINAGE

SOIL PHYSICAL ASPECTS

Infiltration and Water Retention

Surface crusting and poor water penetration are problems of considerable importance in crop and pasture establishment under irrigation in N.S.W.

The Chemistry Branch of the B.C.R.I., Rydalmere has initiated research in the Condobolin and Macquarie Regions to develop reliable techniques for assessing the suitability of soils for irrigation.

Particle size, analysis and aggregate stability studies have shown that soils with high sand and silt content are more prone to surface crusting. Laboratory studies have been commenced to examine infiltration and water retention properties of these soils.

Soil Ameliorants

Restricted water entry was also considered to be the problem causing poor growth of tomatoes on a sandy loam soil overlying a heavy clay near Leeton. The problem appeared to be accentuated by heavy land grading during land forming operations. The "fill area" resulted in crop failure whilst the "cut area" produced an excellent crop.

At Leeton A.R.S., five chemical and physical treatments including lime, gypsum and deep ploughing on three sites with varying intensities of land grading were compared. Heavy rain during the growing season reduced water entry problems and no definite conclusions were possible from the yield data during the current season.

Manganese Toxicity

Waterlogged conditions such as may exist in very wet and poorly structured soils have been observed to give rise to very high manganese levels. Work is planned at the Rydalmere B.C.R.I. to equilibrate a number of soils to different moisture potentials and measure the increase in manganese over varying periods of time.

X-ray Diffraction

A technique designed to classify the soils of N.S.W. with respect to their nutrient supplying and fixing capacity is being developed at the Rydalmere B.C.R.I. The technique necessitates identification and measurement of the amorphous clay minerals present using an X-ray diffractometer and relating their occurrence to geology and soils. Such information will enhance the soil testing research programme of the Chemistry Branch.

Among the many samples analysed, in connection with irrigation problems, some from the M.I.A., Trangie, and Condobolin have shown a predominance of kaolinite and illite. It is not yet possible to make a reliable estimate of the amounts of clay minerals present in the samples.

IRRIGATION MANAGEMENT

Moisture Stress and Water Use

Experiments have been conducted with maize and sorghum crops over the past two seasons at Leeton A.R.S. Results showed that with good management, the difference in yield and water use was small when sowing in hills or on the flat. Although plant emergence was reduced by sowing on the flat, the yield difference in grain sorghum was only 3 bus/ac.

Preliminary investigations on the effects of moisture stress in sunflowers indicated the need for more suitable techniques to measure plant moisture stress parameters in the field. The subsequent research programme is designed to investigate techniques, irrigation frequency and water use.

Irrigation on a 4 in evaporation interval resulted in the most efficient yield during the first season from four lucerne cultivars at Leeton A.R.S. The experiment also confirmed the susceptibility of lucerne to waterlogging.

Trickle Irrigation

An experiment to develop criteria and water requirements of apples, peaches, grapes, and citrus from planting until bearing with trickle irrigation has been in progress since 1969 at Yanco A.R.S. The effect of four watering treatments on tree growth rate is being compared with and without a surface mulch of polythene. The most noticeable response has been in the mulched treatments although small responses have been obtained from the different water applications. The water application rates have proved satisfactory for all fruit trees except peaches, where it was necessary to double the application rates during summer to maintain satisfactory soil wetting patterns.

Tile Drainage

The design criteria for tile drainage installations on the M.I.A. have been tested over a number of years at the Griffith V.R.S. The investigations are designed to determine the critical levels and duration of water table situations likely to cause injury to canning peaches, oranges and grapes.

Induced critical autumn water tables have been lowered at a sufficient rate by tile drains spaced 60 ft x 5 ft to satisfy the requirements set out in the criteria for tile drainage design. Wider spacings and shallow depths have not satisfied the requirements and critical water tables adversely affected the health of peach trees. Recession of water tables is rapid during the spring due to increasing rates of evaporation and water usage and did not constitute a problem to tree health.

CROPS AND CROP PRODUCTS

VEGETABLES

Beans

The breeding programme maintained at Hawkesbury Agricultural College aims to develop varieties with cold tolerance. Out of ninety-three varieties and crossbreeds seven were selected for seed increase and subsequent yield trials.

Experiments on the spacing and density of green processing beans in the Grafton district showed that greater yields can be obtained from high density plantings than from conventional plantings.

The nutrition work at Alstonville T.F.R.S. showed that manganese toxicity can be corrected by the application of either calcium or magnesium carbonate. Aluminium toxicity was more severe than manganese toxicity but was markedly reduced by the application of superphosphate at 5 and 10 cwt per acre. Aluminium appears to be more harmful to plant growth in Alstonville soils than manganese.

Studies on the resistance of varieties to the diseases summer death, clover stunt and rust were continued and studies initiated into the inheritance of resistance to summer death in Australia and curly top in the U.S.A. Sixteen new lines of dry beans were either immune or highly resistant to rust, while the association between the three yellows-type virus diseases was confirmed over a greater range of varieties. An important by-product of this work was the release of disease-free seed of forty-one lines. This is the only programme in Australia for raising and releasing disease-free seed of edible dry beans.

Cauliflowers

Traditionally, cauliflowers have been marketed in a loose condition with leaves attached. Some leaves are trimmed off in the markets and result in substantial cleaning expenses to the Markets Authority. A pilot trial examining various ways of packaging, leaf trimming and containers indicated that cauliflowers can be extensively trimmed and transported satisfactorily in a number of different types of containers. Adoption of these practices will effect substantial savings in transport and marketing without lowering the quality of the product. The curd comprises only one-third of the total weight of a cauliflower marketed in the untrimmed condition.

A second trial examined the weight loss of cauliflowers subjected to three degrees of leaf trimming and wrapped or not wrapped with a polyvinylchloride film. Weight losses after six days ranged from 22 per cent in the case of untrimmed and unwrapped to 2 per cent in the case of fully trimmed and wrapped cauliflowers.

Field trials on the chemical control of club-root were inconclusive because of the low and uneven incidence of the disease.

Bioassay investigations were commenced to determine the relative toxicity of various insecticides to the main insect pests and to note any apparent specificity. Work was also commenced on the integrated control of insect pests by the use of parasites, predators, diseases, less susceptible plant varieties and specific insecticides.

Onions

Various herbicides were tested for weed control. Chlorthal, propachlor, aziprotryne, nitrofen, and ioxynil gave satisfactory results. A combination of chlorthal and propachlor as a pre-emergence spray gave excellent results.

Potatoes

In the breeding programme at Glen Innes A.R.S. one thousand and ninety-three crosses were made. Selections were made at all steps in the programme, thirteen being retained from the advanced yield trial. District trials of promising seedlings were resumed in the major potato producing districts.

Physiological studies continued at Orange A.R.S. as well as the assessment of cooking quality of advanced breeding lines.

At the Rydalmere B.C.R.I. and at Crookwell, field trials examined the efficacy of several fungicides in combating Rhizoctonia disease. Vitavax tuber dust gave the best results.

Sweet Potatoes

The yield and quality of sixteen varieties was compared in a trial at Alstonville T.F.R.S. Orange fleshed varieties from the U.S.A. gave the highest yields (two to three times the yield of White Maltese, the standard variety) and the best shaped roots.

A fertilizer trial with all combinations of three rates each of nitrogen, phosphorus, and potassium was conducted at Cudgen. The yield results were quite unexpected as no response was obtained to either phosphorus or potassium and there was a negative response to nitrogen. A similar trial but with a different variety, is planned for next season.

Because of the importance of virus diseases in sweet potatoes a survey was conducted throughout the major growing area on the north coast. All crops of the White Maltese variety were found to be infected.

Tomatoes

Two new hybrids developed at Hawkesbury Agricultural College, VF College Cropwell and VF College Globe, were released. Some highly promising selections were made in advance generations from the crosses Kokomo x Rouge de Marmande and Step 286 x Anahu.

The use of clear plastic tunnels over early trellised crops again hastened fruit maturity in demonstrations at Gosford.

Studies on the ripening of tomato fruit showed that green life and shelf life can be increased by up to 2 weeks by storage in polyethylene film bags in which the atmosphere contains about 5 per cent carbon dioxide.

Fumigation of tomato fruits with methyl bromide was found effective against the eggs of Queensland fruit fly but not sufficiently effective against the larvae.

In field trials for the control of sclerotinia disease, best results were obtained with Benomyl (1 lb product in 100 gallons water) and Benomyl white oil ($\frac{1}{2}$ lb product + 1 per cent white oil).

Field and laboratory studies of the root knot nematode were undertaken. A field trial with tomatoes showed the chemicals phenamiphos and aldicarb to be effective control agents.

Capsicums

Capsicums grown in this State can be infested with Queensland fruit-fly against which most States enforce strict quarantine. Control treatments investigated at Gosford showed that fumigation with ethylene dibromide (22 oz per 1,000 cubic feet for 2 hours at 20° C) is successful. This treatment has been approved by the other States for the interstate marketing of N.S.W. capsicums.

Mushrooms

New formulations of composts were devised. They included cotton seed hulls, cotton seed meal, sunflower seeds, brewers grain and molasses, and gave yields equal to or better than normal composts of straw and animal manures. Preliminary investigations have been made of the moisture characteristics of a number of peats used in mushroom culture.

Samples of diseased mushrooms, examined at the Rydalmere B.C.R.I., were found to contain several mushroom viruses while one commercial strain of spawn contained virus particles. A standard procedure for heat therapy of virus infected cultures was developed. Three bacterial antagonists of the disease known as bacterial blotch, *Pseudomonas tolaasii*, were found. They effectively controlled the disease in trials undertaken.

The chemicals thiabendazole and benomyl under laboratory conditions gave promising results in the control of two pest nematodes, *Aphelenchoides composticola* and *Ditylenchus myceliophagus*. Evaluation under commercial conditions is planned.

TOBACCO

Curing Kiln

A small tobacco curing kiln was designed and constructed by the Glenfield Agricultural Engineering Centre for use by the tobacco research group based on the Glen Innes Agricultural Research Station.

Transplanting Investigations

An even stand of plants is particularly important for mechanized tobacco production. Investigations were continued to determine the optimum seedling age for transplanting and the effects of moisture stress. In the past two seasons the youngest peat pelleted seedlings received the least setback in the transplanting operation. Peat pelleted seedlings transplanted after 42 days in the seedbed showed superior growth rates to seedlings transplanted after 56 or 70 days. Unstressed bare root seedlings transplanted at 42 days showed an increase in total dry matter during the first 15 days after transplanting whereas older bare root seedlings showed a decrease. However, 42 days old bare root seedlings have stems too small for satisfactory machine transplanting. Small plants appeared less stressed by transplanting than large. Leaf area may thus be as important to recovery as seedling age.

Rate of Harvest

Owing to the increasing cost of hand-picking tobacco, preliminary investigations began to determine the effect of an increased harvesting rate on leaf quality, particularly the effect of applying a senescence inducing agent.

Nutrition

Varying rates of nitrogen, phosphorus and potassium were applied to a sandy loam alluvium at Ashford. There was no benefit in applying these fertilizers to tobacco grown on this soil in the first season. In fact nutrients delayed maturity.

Sucker Control

Nematode damage prevented conclusive results but it appeared that a single application of aliphatic alcohol based chemicals such as Off-Shoot T, Axileen and Emtrol 1630B provided a high degree of sucker control.

COTTON

Verticillium Wilt in Cotton

This disease has the potential to be the major problem reducing cotton yields in N.S.W. Research has been oriented towards reducing the level of disease in the soil (soil fungicides and decoy cropping) and at producing improved varieties. Experimental lines of cotton which are less susceptible to the disease have been produced at Narrabri A.R.S.

Insect Pests

Field studies are being carried out in the Namoi Valley on the two major cotton pests, Rough Bollworm and *Heliothis*. Ecological studies are also in progress to evaluate natural changes in populations of these pests and their predators and parasites.

Integrated Research Programme

At Narrabri and Trangie Agricultural Research Stations, an integrated programme has been designed to study the agronomy, weed control, nutrition, physiology, and breeding of cotton.

Agronomy.—Experiments are being conducted to investigate the effects of time of sowing, plant populations, and row spacings on yield and quality of cotton.

Nutrition.—Recent fertilizer studies in the Namoi Valley have shown no response of cotton to phosphate. Similar investigations are now being undertaken with zinc.

Physiology.—An examination is being made of the physiological bases of yield and how these are modified by agronomic practices and varietal differences.

Cotton breeding.—In an attempt to improve yield and quality of cotton varieties, the breeding programme is conducted in association with an introduction, screening, and evaluation programme.

Cotton Fibre Quality

The Department's Fibre Testing Laboratory in Sydney is designed to study fibre testing methods and to test fibre samples for cotton research workers.

OIL SEEDS AND GRAIN LEGUMES

Declining wool prices and the introduction of wheat quotas have forced primary producers to look for alternative forms of production. One of these is the growing of relatively new crops such as oil seeds and grain legumes. To meet the demand for information concerning the production of such crops, a substantial research programme has been mounted.

Rape

Rape is an obvious alternative crop to wheat in cerealgrowing areas, having similar climatic requirements to those of winter cereals. It is also adaptable to cooler tableland areas, and the crop was investigated at Leeton, Temora, Cowra, Canberra, Tamworth, and Glen Innes. Yields were often very satisfactory, with the top production being 3,204 lb/ac at Leeton A.R.S.

Cultivars were compared at each of the sites mentioned above; in general, the annual types of *Brassica napus*, such as Target, were higher yielding than the annual types of *Brassica campestris*, such as Arlo. The biennial types of *Brassica napus*, such as Lembke's Koolzard, did not demonstrate any yield superiority, except at Cowra A.R.S. where the highest yield was obtained from a biennial cultivar, Rapol. The biennial types did not produce seed at Temora A.R.S.

Sowing times were investigated at each of the sites. Results were very variable, due to erratic and often unfavourable seasonal conditions. Earlier sowings were generally better than later sowings at Cowra A.R.S. and Temora A.R.S. At Glen Innes A.R.S., *campestris* types performed satisfactorily from sowings made as late as the end of December, whereas *napus* types were unsatisfactory at this sowing time. Yields generally declined with later sowing times at Canberra, and biennial types sown later than August failed to flower.

Sowing rates were examined at Temora A.R.S., Cowra A.R.S., and Tamworth A.R.S. At Temora A.R.S., a rate of 8 lb/ac was consistently too heavy; either 2 or 4 lb/ac, according to cultivar and sowing date, gave highest yields. At Tamworth A.R.S., the optimum sowing rates for campestris cultivars Arlo and Echo were much lower than for the napus cultivar Target at early sowings, but in the later sowings the optimum sowing rates were high for all cultivars.

Fertilizer responses were measured on an infertile site near Canberra, and yield was maximized at a combination of nitrogen at 80 lb/ac and superphosphate at 225 lb/ac.

Insect pests can be damaging to rape crops, and a number of entomological investigations were undertaken. At Tamworth A.R.S., it was found that none of eleven rape cultivars tested was resistant to aphids. As one of the problems with the use of insecticides to control aphids in rape is that bees may be severely affected, a trial was conducted at Cowra A.R.S. to investigate this aspect. Endosulfan and primicarb were found to be relatively non-toxic to bees. Investigations in the Wagga and Cowra districts showed that insect damage in rape was relatively light, although serious damage by cabbage centre grub was recorded in some crops.

A serious disease of rape is blackleg, and surveys showed it to be prevalent in higher rainfall southern districts, with failures occurring when crops were sown on areas infected with blackleg in previous years.

Although rape is a strong competitor with weeds, herbicide treatments were tested in the Southern Tablelands and at Tamworth. Nitratin, alachlor, carbetamide, nitrofen, dicamba, and 2,2-DPA gave satisfactory weed control on the Southern Tablelands. Nitrofen was promising at Tamworth.

Sunflowers

There has been a large increase in the area sown to sunflowers in N.S.W., and investigations have accordingly received attention at Canberra and at Leeton, Trangie, and Glen Innes Agricultural Research Stations.

Cultivar comparisons were made at all centres, the general result being that there was no marked difference in yielding ability of the various lines.

Sunflower agronomy under irrigation was investigated further at Leeton A.R.S., where trials in 1970-71 showed that yields declined consistently from a late October sowing to a mid-December sowing. Time of sowing trials at Canberra and Tamworth A.R.S. showed that although emergence and early seedling growth could be obtained from August and September sowings, subsequent frost damage seriously reduced yields.

Entomological surveys of sunflower crops in northern N.S.W. were done to ascertain the types of insects infecting the crop and to indicate those of potential economic importance. Several centres reported considerable infection of the crops by white rust, which could be a potentially serious disease.

Other Oil Seed Crops

Linseed.—This crop was examined in a trial at Cowra A.R.S., where the standard cultivar Bonydoon was considerably outyielded by the cultivar Imperial. At Canberra, linseed performed very poorly and was unable to cope with weed infestation.

Sesame.—Seed increase and mechanical harvesting trials were attempted at Narrabri A.R.S. One line of Sesame (A-381) yielded well at 425 lb/ac.

Castor bean.—Seed increase was carried out at Narrabri A.R.S. One plot of Crambe in a trial at Canberra was header-harvested to yield 562 lb/ac.

Oilseed Analyses

The Chemistry Branch of the Rydalmere B.C.R.I. is co-operating with the Division of Plant Industry with investigations of oil quantity and quality factors associated with field trials with rape, sunflower, linseed, and soybean. Of particular importance is the role of the Chemistry Branch in analysing for oil and protein levels in the Soybean Co-operative Variety Evaluation Trials conducted by the N.S.W. and Victorian Departments of Agriculture and the Universities of Sydney and Brisbane.

Because of current concern over health aspects related to the degree of saturation in edible oils generally and erucic acid levels in rapeseed oil particularly, investigations into some of these aspects have been commenced.

Field Peas

This crop received attention at Canberra, and at Wagga, Temora, Cowra, Canberra, Tamworth, and Narrabri Agricultural Research Stations. In spite of unfavourable seasonal conditions its performance was generally satisfactory. The maximum experimental yield reported was 2,336 lb/ac at Canberra, with the lowest yield of 318 lb/ac at Wagga.

Cultivar comparison trials showed that Derrimut was the highest yielding cultivar at Wagga, Narrabri, and Cowra; at Temora, Early Dun was highest yielding, whilst at Tamworth there was no significant difference between cultivars. White Brunswick was the lowest yielding cultivar at Wagga, Cowra, and Temora.

Sowing rate trials at Wagga, Cowra, Temora, and Tamworth showed that optimum sowing rate was in the order of 90 lb/ac.

Fertilizer and inoculation trials at Canberra showed no responses to superphosphate on a fertile soil; large responses to inoculation however, were measured.

Lupins

Investigations with lupins were conducted at Canberra, and at Wagga, Temora, Cowra, Tamworth, Glen Innes, and Narrabri Agricultural Research Stations. Reports on this crop were generally unfavourable. Complete failure was recorded at Tamworth A.R.S. and the highest yield reported was 1,400 lb/ac from a hand-harvested plot at Temora A.R.S.

Only one centre—Temora—conducted a cultivar trial, and in this small hand-sown experiment the highest yielding cultivar was *Lupinus albus* WBI in an early May sowing. There was generally no significant difference in yield between the three narrow-leaf cultivars Uniwhite, Uniharvest, and Unicrop.

A sowing rate trial conducted at Cowra indicated that there was no advantage in using rates higher than 60 lb/ac.

Time of sowing trials were conducted at Temora, Cowra, Canberra, Glen Innes, and Tamworth. The Tamworth trial failed, and at Glen Innes a sowing date of 19th November produced plants which were physiologically injured due apparently to a daylength effect. May sowings at Temora and Cowra were superior to June sowings, whereas at Canberra, August sowings were superior to earlier sowings.

Inoculation trials at Temora showed that lime pelleting after inoculation did not reduce yield. At Canberra, lime pelleting reduced nodulation rating, but this effect was not measured in grain yields. There were large responses to inoculation on a low fertility site at Canberra, with the non inoculated treatments producing virtually no grain yield; on a high fertility site, however, there was no response to inoculation.

Susceptibility to weed infestation was one of the major disadvantages of lupins, as reported by Wagga, Canberra, Tamworth, and Narrabri. Herbicide trials conducted at Wagga and The Rock indicated that simazine, propazine, and fluometuron as pre-emergence herbicides controlled a number of weeds and increased lupin grain yields three fold, whilst carbetamide as a post emergence herbicide also resulted in good weed control and a three to four fold yield increase. In the Southern Tablelands, carbetamide was the best herbicide. A mathematical model of field results has shown that the yield of lupins was in general related to the quantity of weeds present in the crop.

Soy Beans

Soy bean cultivars were compared in irrigated trials at Narrabri, Trangie, and Leeton Agricultural Research Stations, with Clark + 30, Dare and Bragg giving consistently high yields at first two centres, and Hill and Clark 63 being the highest yielding cultivars overall at Leeton. Top yields over 3,000 lb/ac were recorded.

A time of sowing trial at Leeton, showed that longer season varieties such as Hill and Lee would be better sown in October, whilst medium season varieties such as Bethal, Kent, and Clark 63 would be best sown in November. At Narrabri, a time of sowing trial indicated that for the cultivars Bragg, Lee and Hill, highest yields were generally obtained from a November 22 sowing time, with later sowings giving consistently lower yields.

A disease caused by soy bean mosaic virus, was investigated by plant pathologists of the Rydalmere B.C.R.I. No transmission of the virus through seeds could be demonstrated.

Miscellaneous Grain Legumes

Edible dry beans were tested at Narrabri A.R.S., and results indicated several cultivars, including the commercial cultivar Borlotti, were adapted to the environment and warrant further study. Lima beans were also tested at this centre. Several cultivars were shown to be adapted, and the disadvantage of sowings in January and February were indicated.

Mung beans were grown for seed increase at Narrabri A.R.S., some 900 lb of seed being harvested from 1½ ac.

At Glen Innes A.R.S., tick beans were examined. Results showed that the "spring" types, such as Tarwin performed much better than "winter" types, such as Maris Beaver.

At Canberra, various vetches and lathyrus lines were sown in a general time of sowing trial, but the performance of these did not match that of field peas.

WHEAT BREEDING

Wheat Improvement in Central and Southern N.S.W.

Dryland programme.—An integrated programme of wheat improvement is conducted at the Agricultural Research Institute, Wagga Wagga and at Temora and Condobolin Agricultural Research Stations.

Following the acceptance of Falcon and Eagle as the basis of hard wheat production further improvements have been sought using these cultivars as recurrent parents in back-crossing programmes aimed at the incorporation of the semidwarf growth habit. One line designated DARF maintained its superiority in yield and quality over Eagle and Falcon and has been promoted to Farmers Variety Trials in 1972. Seed stocks are being increased by registered seed growers for possible release in 1974. Another promising derivative—Winter DARF performed well in regional trials. This line incorporates winter habit and semidwarf stature with a valuable resistance to stem rust derived from *Agropyron elongatum*.

The semidwarf programme has been based on introductions from Mexico but up to now this material does not meet the strict quality standards set by the Australian wheat industry. However, progress can be reported from studies which have led to the selection of one crossbred "7147" which combines a high yield potential with particularly good milling and baking qualities. This line is being increased on Research Stations in 1972 and is also being evaluated in the Interstate Variety Testing programme.

Basic genetic studies of developmental patterns has led to the identification of four major dominant genes which inhibit winter growth. This work has pointed the way to new possibilities in the fashioning of types more closely matching the environment of the Southern Wheat Belt. For some time growers have been seeking cultivars specifically adapted to early sowing and it now appears that a switch from "spring" to "winter" types will meet that requirement. This would be expected to raise yield potentials whenever the season permits sowing in late April and early May.

One outstanding crossbred WW15 has been shown to carry the single dominant gene *Vrn 1*, and when present, it completely suppresses any responsiveness to cold temperature vernalization treatment. Work has shown that, when such cultivars are crossed to any one of a large group of spring wheats which exhibit a positive vernalization response, then it is possible to secure transgressive segregates of winter habit. Winter derivatives have been obtained in this way, and, should their early promise be realized, it would represent the first occasion where a commercial winter cultivar has been obtained from crosses between two spring parents.

While the south is relatively free from disease problems, there are two currently under investigation. Septoria leaf blight, so troublesome in wet years, can possibly be brought under control by the breeding of resistant crossbreds. One such line—M1224-2 has performed sufficiently well to warrant consideration for release. It is a later maturing, soft grained wheat which has performed well alongside Olympic.

With the pending withdrawal of the two standard seed dressings, HCB and the mercurials, attention is being directed to the breeding of cultivars resistant to bunt or stinking smut. Three Wagga Institute varieties, Heron, Robin, and Raven, are resistant at the present time and steps are being taken to incorporate their resistance in newly developed wheats.

Of the cultivars recently released from other centres good yield performances have been recorded for Halberd, Darkan, and Bokal, while the northern cultivars Gatcher, Tarsa, and Timgalen appear to have little promise for the southern wheat belt.

Irrigation wheat programme.—This programme based at Wagga A.R.I. embraces field evaluation tests in the Murrumbidgee and Coleambally Irrigation Areas. Early selection work is also undertaken at Yanco A.R.S.

A rust epidemic at Coleambally was useful in demonstrating the good resistance to both leaf and stem rust of the two soft crossbreds WW35 and WW36. At Willbriggie the trial yielded grain samples of low protein content and further laboratory tests with these two lines indicated their suitability for biscuit manufacture. An unanticipated development was the discovery of winter plants in a summer increase of WW36. These winter selections might well be better suited to the irrigation environment than the spring component, because they should be able to be grown successfully over a wide range of planting dates.

Progress has also been made in the production of back-cross derivatives of Pinnacle possessing short straw and adequate resistance to stem rust combined with the dual purpose biscuit and bread baking quality of Pinnacle.

Wheat Improvement in Northwestern New South Wales

Based on the Agricultural Research Station, Tamworth, the northwestern programme, which currently emphasizes the production of frost resistant varieties, is supported by field testing at Manilla, Quirindi, Gunnedah, Narrabri, Moree, and Coonamble. A new type cone-seeder, evolved on the Station, is now in routine use for off-station trials.

Bread wheat.—The outstanding cultivar overall was TR380, bred by Sydney University. This was followed by a crossbred recently registered as Tarsa—a midseason cultivar designed to replace Festiguay. It produces grain acceptable in the Prime Hard category. Once again Gatcher produced relatively low protein grain as did the southern wheat Eagle.

Selection for disease resistance was hampered by low infection rates in flag smut and rust.

Progress in selection for grain quality was much more satisfactory with special attention being paid to flour yield and colour.

Durum wheat.—The durum wheat industry, originally based on the cultivar Dural, now embraces the semidwarf Duramba released in 1970. Like Dural, Duramba is late maturing.

During the season under review six trials were harvested, but none of the entries showed sufficiently outstanding performance to justify seed increase.

Some difficulty is being encountered in establishing a satisfactory set of quality standards for new material. Colour standards are difficult and may be complicated when very high protein levels impart a grey colour.

The Australian Wheat Collection

Founded in September, 1968, the Collection has now accessioned over 15,000 varieties. In the past year, 41 requests totalling 792 entries were supplied to 27 different workers in Australia. During the same period 10 requests totalling 201 entries were sent to workers in 7 countries overseas. In return, 374 samples were received from 14 countries. This represents a drop in the rate of importation, but an increase in the range and selectivity of samples being sought.

The rapid early growth of the Collection led to a good deal of duplication. Samples carrying the same designation are now being grown together and, if identical, will be bulked. In many cases varieties carrying the same name are significantly different. The process of bulking duplicates will take several years to complete.

The record system of the Collection has progressed greatly during the year. The card index (both shelf list and alphabetical) is complete in all detail. The Collection register is complete in that all names have been entered, but without as yet the inclusion of all available basic data.

WHEAT CROP PHYSIOLOGY

Studies of the physiology of the wheat plant were centred at the Tamworth A.R.S. and the Wagga A.R.I. The essence of this work is the further understanding of the productive capacity of the crop, and of its ability to withstand environmental stress. At both centres, there is close integration of the physiological and breeding programmes.

Crop Growth Analysis and Frost Injury

At Tamworth A.R.S. the focal point of research is the problem of frost injury. Field studies were designed particularly to determine the optimum variety type and planting date to ensure that the critical process of grain filling takes place under the most favourable conditions, that is, the period immediately after the last damaging frost is expected to occur. Variety performance was measured in terms of yield components, photosynthetic area and reaction to temperature and photoperiod.

In the laboratory further progress was made in the construction and use of artificial freezing chambers. Some hundreds of new varieties and selections were assessed in this way for resistance to low temperature at various stages of growth and the best of these were sown in the field to check performance under natural conditions. A study was also made of the effectiveness of chemical and biophysical assessment of cell damage as a guide to frost resistance. This gives promise of providing a test which can be applied to plants growing in the field, and will complement studies of the effect of freezing on the photosynthetic system as measured by gas analysis techniques.

Water Use Efficiency and Drought Resistance

At the Wagga Wagga A.R.I. the study of the relation between the physical state of the soil water under conditions of stress and plant growth has been continued. The early results are promising in that they suggest a possibility of quantifying plant growth responses irrespective of particular stress conditions. However there are considerable experimental difficulties arising from the need to handle plants having very low growth rates, and the work has not yet reached a conclusive stage.

Good progress has been made with the co-operation of the Glenfield Agricultural Engineering Centre, in the construction of a weighing lysimeter. This is to be installed in a field crop as part of the programme to relate crop growth and water-use to meteorological conditions.

Evapotranspiration and Crop Growth

In order to understand better the relationship between crop growth, development and evapotranspiration and climatic parameters a joint project with Macquarie University was undertaken. For this project a 70 ac paddock at the Wagga A.R.I. was divided into four equal blocks, on each of which a separate treatment was imposed. For 1970 and 1971, time and rate of sowing with wheat were investigated while subterranean clover, rapeseed and two treatments using wheat are currently being examined.

Evapotranspiration is being calculated using the energy balance approach. As a further check a neutron moisture meter is being used to measure soil moisture changes.

WHEAT QUALITY

The departmental wheat improvement programme is based on the integration of field and laboratory assessment. The Department has cereal quality laboratories at Tamworth A.R.S. and Wagga A.R.S. where the work of the chemists and technicians is closely integrated with the wheat breeding programmes conducted at these centres.

A central laboratory is located at the Rydalmere B.C.R.I., which has a co-ordinating function in quality assessment of wheat crossbreds approaching the release stage, as well as regulatory functions with regard to the export of wheat, flour, and other grains. As the major percentage of wheat is exported, research programmes have a strong orientation towards marketing.

Quality Assessment

Standardized laboratory techniques are employed to assess the milling and baking qualities of developing crossbreds, but due to constantly varying environmental conditions during crop growth it is essential to test promising material together with commercial varieties over a range of sites and seasons.

Weather damage.—A collaborative project by chemists from Yanco A.R.S. and Rydalmere B.C.R.I. has recently been successful in developing a rapid and accurate method for determining alpha amylase by labelling undamaged starch granules with an organic dye. The colour of the dye is reduced when acted upon by extracts of wheat samples and the colour reduction is proportioned to the amount of alpha amylase present. The test is also applicable to other grains including rice, barley, and rye. The technique can measure weather damage in grain which is not detectable to the naked eye. Because of the simplicity of the test, it has potential as a screening test in plant breeding programmes particularly in northern N.S.W. where attempts are being made to breed for dormancy in white wheats.

Grain hardness.—A simplified and rapid technique using a barley pearler has been developed for measuring grain hardness. A broad scale survey of varietal hardness (pearling resistance) has been undertaken covering all available varieties and crossbreds from over sixty trials in each of three growing seasons. It was confirmed that pearling resistance is a varietal characteristic modified by seasonal conditions and to a lesser extent by locality. Moisture content, grain protein, 1,000 grain weight and bushel weight showed no significant correlations with pearling resistance which was concluded to be a simple characteristic of particular value in assessing a variety, particularly in plant breeding work. Pearling resistance was positively correlated with visual vitreous appearance of wheat samples.

Flour milling and starch damage.—Starch damage in milling is an important economic factor as a certain percentage is desirable for the production of reasonable bread yields from a given quantity of flour. Starch damage is related to grain hardness and good milling technique and the ideal variety has a grain hardness in the median range as measured by pearling resistance. Experimental work is being undertaken to relate optimum milling performance to starch damage and enzymatic methods are being developed to measure the latter character.

WHEAT PRODUCTION AGRONOMY

Mineral Nutrition

Phosphorus.—Phosphorus is deficient in most wheat belt soils. To rectify this, large amounts are spent on superphosphate, which is applied to the soil with the seed. Research programmes on phosphorus are principally concerned with devising reliable soil tests. These will enable the phosphorus fertilizer requirement of paddocks to be accurately predicted after results from laboratory analysis are examined.

Soil test investigations were largely completed in the North West in 1968, but further clarification was required on black and grey cracking clays around Moree. Dry sowing conditions reduced the planned research, but work from Tamworth A.R.S. showed small yield increases on two such sites in 1971.

In the Central West, soil tests have been examined since 1964. Research efforts have been integrated at Condobolin, Trangie, and Cowra Agricultural Research Stations. Seventeen trials have examined the role of soil tests, and the effect of different varieties on test accuracy was assessed. Since results are now available from 240 experiments, appraisal of the soil test is largely complete. This appraisal has involved many soil analyses at the Rydalmere B.C.R.I. and a major statistical analysis by the Biometrical Branch. These combined efforts have demonstrated that soil testing is an important tool in predicting the phosphorus requirements of the crop.

In the South West, the basis for soils tests was decided in 1969 at Wagga A.R.I., and a pilot soil testing service was established in 1969. In 1971, 131 experiments were conducted in this project, and analysis of data indicates that soil tests have acceptable accuracy.

Work on the Southern Tablelands, in collaboration with CSIRO Canberra, has demonstrated in the 1971 experiments that wheat yields increase with phosphorus application, even on paddocks with a history of heavy application.

Nitrogen.—Nitrogen fertilizers are expensive, so research aims at ascertaining how much should be applied in different circumstances. Different types of nitrogen fertilizer are evaluated for their efficiency under diverse conditions.

In the North West, experiments showed that heavy soils in the Moree district do not yet require fertilizer nitrogen.

Seventeen trials in the Central West showed that light red soils cropped exploitatively will respond profitably to nitrogen. Heavier grey and black soils do not. Extensive laboratory analyses by the Rydalmere B.C.R.I., confirm earlier impressions that prediction of nitrogen requirements by laboratory soil analysis is not feasible under Central West conditions.

In the South West, research at Wagga A.R.I. is defining critical nitrogen levels below which nitrogen application is economic. The 125,000 data elements from 900 trials conducted over 3 years have been subjected to computer screening. This will determine which soil and agronomic factors are most important in assessing nitrogen requirements.

Biscuit wheat yields on the M.I.A. are low due to nitrogen deficiency. Biscuit wheat must be low in protein. Work at Yanco A.R.S. has demonstrated that nitrogen fertilizer can be used to increase yields without raising protein content to unacceptable levels. This finding applies to adequately irrigated crops on low fertility paddocks.

On the Southern Tablelands, nitrogen has increased wheat yields, especially in varieties of the semidwarf type.

Alternative nitrogen sources.—More expensive fertilizers are available which supply both nitrogen and phosphorus together. Three experiments in the Central West have provided additional information on when this extra expense gives extra profits. Two experiments in the Trangie district showed that anhydrous ammonia can be superior to ammonium nitrate. Where ammonium nitrate is applied, best results are obtained if the fertilizer is topdressed when the crop is sown.

Legume nitrogen.—At Tamworth A.R.S., a comparison is being made of nitrogen build up by lucerne and cowpeas in rotations. This comparison includes the effect on wheat yields. The 1971 results showed that a wheat-cowpea rotation has produced more wheat since 1966 than areas continuously cropped. Lucerne has fixed enough nitrogen in the soil to supply the needs of four consecutive wheat crops. Economic responses to applied nitrogen fertilizer have only occurred in the fifth crop after lucerne.

Zinc deficiency.—Zinc deficiency has been suspected on heavy alkaline soils of the Macquarie Region and the Liverpool Plains. Seven experiments in 1971 showed no response to current or past applications of zinc on the Liverpool Plains. Since large increases resulted in 1970, the lack of effect may have been caused by dry conditions. Four experiments in the Macquarie region reinforced earlier indications that zinc deficiency does not exist in that region.

Environmental effects on mineral nutrition.—The amount of plant food that a crop will profitably use increases as the growing conditions become more ideal, and thus climatic fluctuations markedly influence the economics of fertilizer response. In 1971, the components of the climate influencing yield were measured in a broad scale project in the Central West. Similarly, work from the Wagga A.R.I. is measuring the effect of climate on fertilizer response in a 3 year study on six sites in the region.

At Cowra, very detailed measurements of climatic changes are related to reactions in the crop. Sufficient information has been gathered to enable crop growth to be described by computer simulation.

Sowing Rates

In 1971, a 5-year series of trials concluded at Condobolin and Trangie Agricultural Research Stations. Results show that 20–30 lb/ac of seed is sufficient in the western margins of the wheat belt. On the more eastern portion of the plains 30–40 lb/ac is sufficient for optimum yields. Experiments conducted at Bellata and Curlewis in the North West were inconclusive due to late sowings, with the probable optimum sowing rate occurring between 15–45 lb/ac.

Cultivation Methods

At Wagga A.R.I., traditional cultivation and sowing methods are being compared with direct sowing techniques into undisturbed soil on which weed growth is killed with chemicals. The new techniques conserve the soil and reduce costs. However, in 1969 and 1970, yields from these new treatments were 20–40 per cent below traditional methods. In 1971, under dry conditions, direct seeding with the triple disc drill was superior to conventional methods. This result needs careful interpretation. Long term appraisal will be needed before definite recommendations are given to growers.

Soil nitrogen changes under a cultivation trial conducted by ICIANZ Ltd, are also being monitored from Wagga A.R.I. Indications to date are that minimum tillage methods conserve soil nitrogen but yields have been 2.7 bus/ac/yr lower over a 5-year period than with conventional cultivation methods.

Weed Control

Trials conducted from Wagga A.R.I. over sites throughout the region have assessed that overall grain yields are depressed by about 17 per cent as a consequence of weeds. No reduction in protein was measured. Information gathered is still being processed to establish which particular weeds cause the major economic loss.

The economic impact of fumitory, spiny emex and saffron thistle has been investigated in the areas south of Parkes. Dry conditions hindered experiments in 1971, but limited results show that spiny emex can be controlled in its earlier stages by a range of herbicides. The safety of these herbicides now needs to be thoroughly investigated.

A general survey of weeds in wheat crops in the Gunnedah-Narrabri district showed that at least ten broad leaf weeds contribute to seriously lowered yields in the North West.

DISEASES AND PESTS OF WHEAT

Take-All

The taxonomy of the take-all fungus was studied at the Rydalmere B.C.R.I. Formerly named *Ophiobolus graminis* it was found to consist of three morphologically distinguishable varieties belonging in the genus *Gaeumannomyces* viz. *G. graminis* var. *tritici* (attacking wheat), var. *avenae* (attacking oats) and var. *graminis*.

In pathogenicity tests of thirty-two isolates, it was demonstrated that the wheat strain of *G. graminis* parasitizes oats and that isolates of all three varieties of the pathogen can attack rice, although there is no evidence that this crop species is affected in N.S.W. The fungus was found on roots of many healthy plants including native and introduced grasses.

Cereal Seed Fungicides

At Wagga A.R.I. an evaluation was made of chemicals for replacement of hexachlorobenzene (HCB) and organic mercury which will be withdrawn because of residue problems. Maneb and mancozeb were as effective in controlling wheat bunt as mercury but inferior to HCB. Sown shortly after dusting, plant establishment and yield were not affected.

The HCB resistant strain of bunt present in Victoria since 1964 was found for the first time in N.S.W.

WINTER CEREALS

Research in winter cereals, other than wheat, is directed mainly towards varietal improvement in oats and barley. However, grazing systems for various winter cereals have been investigated on the southern tablelands, and strategies are being developed at the Rydalmere B.C.R.I. for control of the cereal cyst nematode. Varieties found to be resistant to the nematode will be used in the plant breeding programmes, as there are indications that the currently small infested area in this state could increase in extent in the future.

Plant Breeding Programmes

Oats.—At Temora A.R.S. a new line, M1341, has been developed to replace the current leading grain oat variety, Avon. M1341 yields 10 per cent more than Avon in ungrazed stands. If it is grazed it recovers very well. Seed of this new oat is being increased on research stations during 1972, in anticipation of its recommendation in 1974. Two oat varieties, Cooba and Coolabah, both selected at Temora A.R.S. are now grown on almost half the oat acreage in N.S.W.

Work continues with selection of progeny from crosses with improved grain quality and high grain weights combined with low husk percentages. These selections are being further selected and used in crosses.

At Glen Innes A.R.S., lines are being selected for improved quality and yield for grazing and grain, and for resistance to diseases including rust, an important problem in the north of the state.

Barley.—A breeding programme has been commenced at Wagga A.R.I. Liaison with the malting industry has resulted in the introduction of a quality testing scheme which initially is assessing samples from the 1971 district variety trials. Advanced lines from interstate breeding programmes are in preliminary trials sown in 1972 at Wagga A.R.I. and in the regions.

District Variety Trials

Variety trials are conducted by agronomists on both farmers properties and Agricultural Research Stations. The work is co-ordinated by the Division of Plant Industry.

Oats.—Twenty-one varieties were tested in twenty-five trials. The number of trials harvested was lower than usual because of the adverse season.

These trials included four unnamed crossbred lines: M1341 and M1354 selected at Temora A.R.S., and P4315 and P4319 selected at Glen Innes A.R.S. M1341 performed well as a replacement for Avon. M1354 yielded well in some trials but was often inferior to M1341, and it has fairly weak straw. P4315, a midseason variety, and P4319, a variety for early sowing, have satisfactory tolerance to stem rust and resistance to smut, and have performed well under grazing especially on the tablelands.

The newly recommended variety Irwin performed well when late sown in marginal areas.

Barley.—Thirteen varieties were tested in twenty trials, a lower number than usual.

Clipper was the outstanding variety for yield. The one unnamed line, A.16 from Western Australia, yielded well but was usually inferior to Clipper. Of the new named varieties from interstate, Ketch proved to be a satisfactory replacement for Noyep as a variety suitable for late sowing in marginal areas, and Bussell has been withdrawn from further trials because of inferior malting quality. Lara, a new Victorian variety, was tested in several trials in the south of the State where it yielded very well.

SUMMER CEREALS, MAIZE AND SORGHUM

Sowing Techniques and Plant Density

A number of trials compared levels of plant density of both maize and grain sorghum. Sorghum at 80,000 plants/ac yielded more than at 40,000/ac in a trial at Tamworth A.R.S. Maize hybrids showed different reactions to increasing plant populations in a trial at Grafton A.R.S. Yield of GH390 increased with each increment in plant population up to 24,000/ac, while GH414 was intolerant to crowding.

Row spacings of 14 in and 28 in were compared for both maize and sorghum at Narrabri A.R.S. Sorghum yields were higher from the closer rows, while maize yields were higher from the wider rows. In this same irrigated trial, both sorghum and maize produced higher yields when sown on the flat, compared to sowings on formed hills.

Weed Control

Trials at Tamworth A.R.S. investigated the effects of row width, weeds, cultivation, and herbicides on dry land grain sorghum. Maximum yield was obtained from hand-weeded plots with 12 in rows. Interrow cultivation increased yields only in weedy plots. Weeds competed less successfully in narrow-row plots. Sorghum in narrow rows receiving a band application of herbicide yielded more than wide rows receiving both interrow cultivation and band-sprayed herbicide.

Plant Nutrition

Previous research has shown that zinc deficiency in the Quirindi-Gunnedah area can be overcome by applying zinc sulphate as a seed dressing, as a spray, and as a soil dressing. Residual effects of soil dressings are being compared with annual spray treatments. Initial results indicate that annual treatments may be superior to the residual effect of heavy soil applications, measured in the second year after application.

Pot trials have shown a wide range of reactions by maize lines to zinc deficiency.

Other trials are comparing forms and rates of zinc applications, and investigating residual effects in a wheat-sorghum rotation.

Soil factors limiting yields of irrigated maize in the North West are being investigated at Tamworth A.R.S. The effects of gypsum and sulphur as soil ameliorants, and indole-acetic acid as a seed-dressing, are being investigated in relation to high exchangeable soil sodium.

Insect Pests

Sorghum midge *Contarinia sorghicola* is the most important pest of grain sorghum in northern N.S.W. Methods of control are being investigated, and a statewide survey was made to determine its distribution.

Plant Diseases

Southern Corn Leaf Blight *Drechslera maydis* was identified for the first time in N.S.W. in March, 1972, on the North Coast. The race present is virulent on maize with "Texas" male-sterile cytoplasm; a large proportion of commercial hybrids are thus susceptible. Resistant cytoplasm is available and will be used in future seed production. Maize breeders and pathologists in N.S.W. have planned further studies of this disease, in co-operation with Queensland researchers.

In 1970–1 symptoms resembling those of Red Streak disease of sorghum were reported in northern N.S.W. Yields were reduced by up to 30 per cent. Investigation showed these symptoms were caused by a strain of sugar cane mosaic virus. Some sorghum varieties showed resistance.

Stringent quarantine measures are taken to exclude Boil Smut of maize from Australia. An effective treatment to replace mercurial seed dressings of imported seeds is being sought. Panogen was not completely successful, but sodium hypochlorite appears promising.

Strain differences were observed of the virus causing Maize Dwarf Mosaic, using maize, sweet corn, and sorghum as the differentials.

Maize Breeding

Maize breeding programmes are located at Grafton and Glen Innes Agricultural Research Stations.

With the advent of Southern Corn Leaf Blight, virulent on maize with "Texas" male-sterile cytoplasm, the incorporation of this cytoplasm into elite inbreds has been suspended. Evaluation of resistant male-sterile cytoplasm and a search for genetic resistance has been planned. Inbreds with resistant male-fertile cytoplasm have been released to commercial hybrid seed producers. Use of these will necessitate a return to detasseling to produce hybrid seed.

A reciprocal recurrent selection programme is being used in an attempt to develop early-maturing maize with general resistance to Northern Leaf Blight *Drechslera turcica*. A simply-inherited dominant form of resistance is also being backcrossed into a number of early-maturing elite inbreds.

The Australian Variety Collection was assembled at Glen Innes A.R.S. to preserve maize germplasm available in Australia. To maintain viability and to utilize the collection as a genetic source for further maize improvement, an open-pollinated composite has been synthesised from all entries in the collection. A "convergent-divergent" scheme is used, with the composite being grown at two sites in N.S.W. and two in Queensland to retain its variability.

Other breeding projects include the development of "high-lysine" maize, using the "opaque 2" gene, and the breeding of late-maturing maize with lower ear placement and shorter stature than present hybrids in this maturity group. The dwarfing gene "brachytic-2" is being utilized in the latter project.

Variety Trials

Forty-five maize and ten grain sorghum variety trials were sown throughout the State.

Commercial maize hybrids GH128 and GH390 yielded well in coastal trials, while experimental hybrid GH417 showed promise. Of the early-maturing hybrids in inland trials, a number of closed-pedigree hybrids gave high yields.

High-yielding sorghum varieties included NK212, NK220Y, NK275, Pioneer 846, Texas 671, and E57.

RICE

Rice research, based at Yanco A.R.S. is oriented to the recognition and solution of industry problems through research on breeding, agronomy, crop protection and grain quality.

Varietal Improvement

Two long-grained varieties from the improvement programme will be grown commercially next season following 3 years of regional tests. YR 6-100-9 is early maturing and lodging resistant with the capacity to outyield all varieties now grown. YR 13-89-9 has excellent milling quality and very attractive milled appearance but does not yield as consistently as other varieties.

In preliminary yield trials four high amylose, high quality long-grained lines equalled or bettered Kulu yields and four early maturing lines, sown 2 months later than normal, yielded up to 7,729 lb/ac. At Deniliquin, under adverse conditions, 16 lines outyielded Kulu.

More than 400 crosses were made in the rice improvement programme and a mutation breeding approach was initiated to produce early maturing lines of commercial varieties and hybrids.

Cultural Practices

Rice nutrition.—Two detailed experiments were carried out to determine the best method of preventing nitrogen losses during the flushing period after combine sowing. Applications of more than 2 cwt/ac of sulphate of ammonia did not increase yields due to the high soil fertility. Yield was significantly increased by splitting the application, a starter at sowing and most ($1\frac{1}{2}$ cwt/ac of ammonium sulphate) applied at the stage of permanent water. Deep placement of fertilizer was inferior. Only 30 per cent of the applied nitrogen was recovered from the best treatment in the trials.

Sowing method.—Despite unusually poor establishment, serial sown rice yielded more grain with less fertilizer than combine sown rice in a comparison trial at Yanco A.R.S. Average protein content was 7.62 per cent compared with 5.77 per cent for combine sown rice.

Sowing rate.—Seedrate is not as important in determining yield as nitrogen. Seedrates as low as 30 lb/ac were generally effective but up to 120 lb/ac was required in adverse conditions.

Crop Protection

Weed control.—Molinate was best, but butachlor 17623 and Trifluralin were promising for control of *Echinochloa* spp. in a trial conducted at Yanco A.R.S.

Rice growth was retarded when MCPA was used to control *Cyperus difformis* before the second week of December. There was no effect on yield.

A series of experiments has shown that atrazine residues from applications to other crops in the rotation are unlikely to damage rice—at least on one soil type.

Bloodworm control.—Application of Abate controlled bloodworms in rice when used at the rate of 0.0125 lb/ac of the active ingredient. Double this rate was required in a crop with a dense mat of decaying organic matter.

Abate at 2 oz/100 lb seed and Dursban at 1 oz/100 lb seed were effective seed dressings for rice when combined with Captan.

Straighthead.—Through application of copper sulphate at 50 lb/ac, lime plus trace elements at 3 ton/ac or sulphuric acid, "straighthead", a severe form of sterility in rice was reduced and yields increased. The disorder is unlikely to be a simple deficiency.

Grain Quality

Cooking quality.—A method to rapidly purify rice starch to facilitate the study of rice gelatinisation properties was developed at Yanco A.R.S. It is a detergent technique using purified one per cent sodium dodecylsulphonate.

Milling quality.—Aerial sown rice exhibited better milling quality than combine sown rice, especially after low moisture harvest.

Despite favourable overseas reports, potash did not improve grain quality in four trials.

PESTS OF STORED GRAINS

Insecticide Resistance

Samples of insects infesting stored products for insecticide resistance investigations at the Rydalmere B.C.R.I., were obtained throughout N.S.W. Approximately 200 samples of the following major pest species were examined in the laboratory: rust-red flour beetle, *Tribolium castaneum*, confused flour beetle, *T. confusum*, rice weevil, *Sitophilus oryzae*, granary weevil, *S. granarius* and lesser grain borer, *Rhyzopertha dominica*. All samples of the five species collected from farms were maldison susceptible.

Investigation of resistance in rust-red flour beetle, commenced in 1968, was continued. This year seventy samples were received from fifty-four localities. Samples from thirty country localities and from Sydney were maldison resistant. Fenitrothion and pirimiphos methyl were tested against grain-infesting insects from laboratory-selected resistant strains. No resistance to either material was evident in maldison-resistant rust-red flour beetle. Low order resistance to both materials occurred in rice weevil and lesser grain borer.

Origin of Infestation

The persistence of insects on farms as a factor contributing to infestation of export grain was investigated in February, 1972. Harvesting equipment and grain storages were examined on sixteen wheat farms around Manildra, Molong, Cumnock, and Yeoval. Insect pests found in seven headers included lesser grain borer, rice weevil, rust-red flour beetle, confused flour beetle, saw-toothed grain beetle, *Oryzaephilus surinamensis* and flat grain beetle, *Cryptolestes* sp. Augers and mobile grain bins were infested occasionally. Grain stored for stock feed was the main insect harbourage. These results, similar to those obtained in preharvest surveys around Tamworth and Cowra, indicate that lack of adequate grain sanitation can leave infestation sources material on farms before harvest.

PLANT EXCHANGE

In response to requests, 28 consignments comprising 219 varieties of agricultural seed, including rice, maize, tomato, oats, sunflower, pumpkin, castor bean, and pasture seeds were forwarded to countries including Tonga, England, India, Tunisia, New Zealand, U.S.A., South Africa, Indonesia, Pakistan, U.S.S.R., Switzerland, and Malaysia. The largest consignment of seventy-two varieties was to the U.S.S.R.

Over 400 varieties of seed were introduced from other countries including U.S.A., France, Thailand, New Zealand, Sweden, Canada, India, Italy, Hungary, and China for evaluation and use in plant improvement programmes.

PASTURES

PASTURE ESTABLISHMENT

Pasture Establishment in Arable Situations

Clean seedbed.—In the marginal wheat belt environment at Trangie A.R.S., investigations have shown that while high lucerne plant populations can be established under cereal cover crops, subsequent production from this lucerne pasture may not necessarily be greater than from stands with a lower plant population. On the Southern Tablelands production of lucerne-phalaris pastures sown under cereal and oilseed crops was less in the year after sowing than comparable pastures sown without cover crops. Similarly, on the North West Plains, production from annual legume pastures was depressed by sowing under a cereal crop.

Where pasture species have been sown without companion crops, as with some of the mid-North Coast kikuyu seed work, detailed investigations on the effect of temperature, time, method, and depth of sowing have been carried out: rate and extent of germination was reduced by extreme temperatures in winter or mid-summer; drilling or broadcasting, harrowing and rolling gave acceptable establishment.

The effect of the grazing animal during the establishment phase has been examined on the Southern Tablelands with lucerne-phalaris pastures sown alone. Heavy grazing during establishment severely reduced subsequent pasture production.

Minimum tillage.—Departmental research in this field is aimed firstly at studying the effect of competition by the existing pasture on seedling establishment and secondly at determining those factors which influence and/or amend the competition effects, e.g., time of sowing, species, herbicides.

Work on the Northern Tablelands is examining and evaluating sodseeding as a means of establishing perennial grasses into bloat prone clover dominant pastures. Results from these trials as well as results from kikuyu sod-seeding trials on the mid-North Coast, indicate that competition for soil moisture by the existing sward severely reduces germination and development of the sown species.

Pasture Establishment in Non-Arable Situations

Investigations on the Central Tablelands have assessed both the use of herbicides to reduce the competition effect of the native species, and the value of grazing management techniques following sowing to aid establishment and persistence. Results so far have shown that herbicides can effectively kill or retard existing native pasture thereby improving establishment, but efficiency of kill will vary with location and seasonal conditions. Further, if the improved species are allowed to seed in spring and summer before grazing in the following autumn, the maintenance of plant numbers and subsequent persistence of improved pasture is ensured. Indications are that these management techniques will, within 5 years of sowing, allow prime lamb and vealer enterprises to be supported on this non-arable country.

PASTURE NUTRITION

Diagnostic Studies

For the past 20 years pasture growth in the Albury district has been restricted by undefined soil factors. Preliminary results from chemical analysis of about 200 soils indicate low soil pH and high manganese levels in the surface soil, and excessive levels of sodium and magnesium in the subsoil. A further peculiarity is the presence of low phosphorus levels on soils previously heavily fertilized.

Glasshouse and field studies on coarse granite soils in the Bendemeer district found them to be deficient in many elements and responsive to lime, while a survey of Hunter Valley soils indicated that phosphorus deficiency was widespread.

On the North West Slopes, field studies on previously unfertilized natural pastures have found no responses to added nutrients (including phosphorus, sulphur, nitrogen) in the first year.

A potassium survey on eighteen farms in the Broughton Creek district found one third of the soils to have exchangeable-potassium levels below 200 microequivalents per cent. Detailed studies on potassium-variable soils at Berry are being carried out.

A Southern Tablelands study investigated the effect of different fertilizers and neutral salts on soil pH, aluminium concentrations and the growth of lucerne and phalaris. Further work compared the minor element requirements of subterranean clover and lucerne on an acid soil.

Phosphorus

Plot studies.—Superphosphate rate trials at Cowra obtained pasture responses only where the phosphate status was very low (2ppm, Bray No. 1.). On the eastern fringe of the Southern Tablelands, responses of mixed swards to topdressing rate has shown pasture yield increases up to 8 cwt/ac of applied superphosphate. Annual topdressing produced a more balanced pasture and greater production in the year of application than initial large dressings. Other work on the Southern Tablelands has investigated deep placement of superphosphate, rock phosphate, and lime, and residual effects on lucerne, phalaris, and subterranean clover. Similar work at Condobolin A.R.S. on lucerne and Jemalong barrel medic, found marked production responses to placement at depths, compared to broadcasting or surface banding.

Phosphorus test.—Research has continued on the development of a soil test for phosphorus. Objectives are to determine economic test levels for broad soil types and to quantify the superphosphate required to reach and maintain optimum levels. Trials have been located at Bathurst, Orange, Goulburn, Portland, the Manning and Clarence Valleys, and the South Coast and Tablelands. This technique is proving unsatisfactory on the South Coast where frequent wet periods lead to high phosphorus fixation rates. Studies on undisturbed cores have shown the glasshouse to be an unsuitable adjunct to this work and cores in the field appear more successful.

Grazed pasture.—Studies of the fertilizer requirements of grazed pasture are taking place at Glen Innes A.R.S., Grafton A.R.S., and on farm sites in the southern wheat belt.

On pastures at Shannon Vale Nutrition Station, superphosphate has increased both plant ground cover and white clover content, and consequently improved sheep performance. Topdressing with $\frac{1}{2}$ cwt/ac superphosphate raised the level of soil phosphorus from below 10 ppm to almost 20 ppm in 3 years and it appeared that a test level (Bray) of 20–25 ppm maintained wool production.

Topdressing white clover/grass pastures for beef production is being evaluated from Grafton A.R.S. and this is being complemented by a co-operative study with both the CSIRO, Armidale and the University of New England on phosphorus and sulphur cycling in these grazed ecosystems.

At Wagga A.R.I. and Temora A.R.S. grazing trials on low phosphate (12 ppm Bray) soils have suggested that superphosphate is not required for the ley phase of the normal cereal/ley rotation. These investigations have continued into the cropping phase and further grazing studies are in progress at farm sites. Results indicate that where soil phosphate status was initially high (greater than 30 ppm, Mehlich) both pasture and animal production were not greatly influenced by superphosphate topdressing, while on medium phosphate soils (20 ppm) botanical changes induced by topdressing practice had significant effects on sheep production. Work on phosphorus cycling has indicated that both reduction of faecal particle size and incorporation of faeces into soil improved the availability of faecal phosphorus to plants.

Nitrogen

Research at Wollongbar A.R.S. is evaluating the autumn response of tropical grasses to nitrogen fertilizer and assessing time of topdressing and closure on yield and nutritive value of herbage. Heavy application rates of nitrogen on lucerne at Tamworth A.R.S. have shown no effects in the first 2 years.

On the South Coast, studies of techniques to control the productivity and nutritive value of kikuyu grass pastures found that production was increased by nitrogen applied in January, March, or April. Production from the early applications was higher and protein values lower due to the onset of cooler weather. Protein content depended more on plant age than nitrogen rate in summer but nitrogen rate became almost as important in late autumn.

Lime

Field trials and glasshouse studies at Albury and Goulburn have investigated responses of manganese toxic soils to liming. Subterranean clover pastures on virgin, improved, and highly fertile soils at Albury have shown no response to lime (1,700 lb/ac) despite reductions in soil manganese levels. At other sites responses in lucerne growth have occurred. Manganese toxicity symptoms appeared above a critical level of soil manganese and lucerne and beans were very much more affected than subterranean clover. Variations in soil moisture and temperature affected the soil manganese level.

Research on placement of lime at a depth (3 in) on South Coast pastures has shown first year responses in production, sward composition and soil acidity in contrast to no effects with broadcasting.

At Grafton, responses by both grasses and legumes to lime have been observed and it appears that lime could play an important part in improving pasture nutrition in the Clarence Valley.

EVALUATION OF PASTURE SPECIES AND FORAGE CROPS

Legumes

Important aspects of the Department's research activities are firstly the introduction, selection, and evaluation of useful and potentially useful legumes for specific situations and purposes, and secondly the definition of factors responsible for poor growth and persistence of legumes grown under extreme environmental conditions.

Lucerne.—Comparative agronomic trials at Narrabri, Wellington, Cowra, Leeton, Berry, and other centres have not as yet found any of the newer lucerne cultivars (Siro Peruvian, African, Du Puit, Lahontan, Cancreep) to be clearly superior to the well-adapted and widely distributed Hunter River cultivar.

At Tamworth A.R.S. an evaluation of the contribution of root reserves to lucerne productivity and persistence was completed in 1971. An index of root carbohydrate and protein status appears to be an important consideration in the development of management strategies for lucerne pastures.

The effect of a range of flood irrigation frequencies on lucerne yield and persistence was studied at Leeton A.R.S. All lucerne plants were killed on the continuously waterlogged treatment (no evaporation interval). Lucerne used water more efficiently with irrigation at a 4 in evaporation interval (infrequent irrigation) than a 2 in evaporation interval (frequent irrigation).

Annual medics.—Winter-growing medics occur naturally in pastures of the North West and Central Plains (e.g. burr medic—*Medicago polymorpha*), but their yields are unreliable and most have spiny burrs which contaminate wool. In 1971, the problems of vegetable fault and stock injury caused by the sharp or spiny seeds of many native and naturalized pasture species were reviewed, with the conclusion that vegetable contamination of wool alone was costing the pastoral industry in N.S.W. up to \$7 million each year. Currently, an expanded programme of plant introduction and testing is underway from Condobolin, Narrabri, and Tamworth Agricultural Research Station in an effort to find winter growing, non-spiny legumes which are well adapted to these difficult environments.

Over a number of seasons at Condobolin A.R.S., Jemalong barrel medic has been found to be the best of the winter-growing annual legumes which are commercially available. In 1971, an enlarged range of 16–22 annual *Trifolium* spp. and *Medicago* spp. were sown at four sites, Condobolin, Tottenham, Parkes, and Narrabri. At all sites, *Trifolium* spp. as a group failed to yield as well as *Medicago* spp. Outstanding medics included two cultivars of barrel medic (*M. truncatula*) and one of snail medic (*M. scutellata*); all three grew much better in winter and spring than Jemalong barrel medic. Of particular interest was the general observation that species which flowered earliest also produced most pods, an important attribute for both regeneration and the provision of summer/autumn feed.

A similar programme of species evaluation is located at Narrabri. In 1971, ninety-four temperate annual legumes, predominantly medics and clovers, were established in nursery rows and were compared in terms of plant morphology, winter and spring productivity, seed production and persistence. This comparison is continuing. On the basis of results in 1971, twenty-two species, mostly medics, were selected for further testing.

Subterranean clover.—At Tamworth, another environment which lacks well-adapted winter-growing legumes, research emphasis is placed on understanding the factors important for the long-term persistence of annual legumes. Most of the work is being done with a range of subterranean clover cultivars, but medics and Namoi Woolly Pot Vetch (*Vicia dasycarpa*) are included in some trials. During the winter droughts of 1970 and 1971, the latter legume produced significantly more dry matter by the end of winter than any other species tested.

At Leeton A.R.S. the problem is one of finding low-oestrogen cultivars of subterranean clover which are equal in agronomic performance to Yarloop and Dwalganup. In terms of dry matter production and resistance to waterlogging, three low oestrogen *T. subterraneum* spp. *yanninicum* cultivars (39314 YA, 39314 YB, 39313 Y) appear the equal of Yarloop. However, their usefulness may be limited by their inability to compete successfully with Yarloop when sown in a mixture. Daliak and Seaton Park subterranean clovers, Hykon rose clover, Jemalong barrel medic and Hunter River lucerne show promise as a replacement for Dwalganup subterranean clover on non-irrigated sites.

In the cool wet parts of the Southern Tablelands of New South Wales (e.g. Jerangle, Kybean), white clover (*Trifolium repens*) competes strongly with subterranean clover in pasture mixtures. Since subterranean clover has some advantages over white clover (better winter growth, lower risk of bloat), an investigation of the factors determining subterranean clover survival when in competition with white clover was started in early 1972.

Cluster clover.—Since 1970, a research programme at Canberra has investigated the ecology of cluster clover. A large range of ecotypic material of this species is present naturally in Australian pastures but its agronomic potential is not known, and the species has not been exploited commercially. Some advantages of *T. glomeratum* defined were an ability to persist at high stocking rates and during drought, prolific seed production, high palatability to sheep, and satisfactory growth on low fertility sites. Disadvantages included poor growth at low soil temperatures and susceptibility of seedlings to competition.

White clover.—Trials at Maitland, Grafton, Leeton, and Berry have indicated the superiority of two Mediterranean ecotypes of white clover, Tamar and Haifa, over commercial cultivars of white clover, including Ladino and Grasslands Huia. Haifa is also being examined as a winter pasture species for the Manning River.

Subtropical legumes.—At Grafton A.R.S., sixty-three legume introductions, including thirty *Stylosanthes* spp., sixteen *Desmodium* spp. and thirteen *Trifolium* spp., are currently under observation in nursery rows. In 1971, seed from a further six promising introductions, including *Aeschynomene falcata* and *Trifolium repens* cv “Haifa” was increased. Small plot trials were established to investigate the effectiveness of native rhizobia on *A. falcata*, the effect of seeding rate on yield and persistence of native glycine, and the compatibility of Haifa white clover with kikuyu. At a more advanced stage of testing, legumes such as *A. falcata*, glycine, and Haifa white clover are being evaluated in small plot grazing trials with cattle where their persistence, palatability and possible toxicity are being assessed.

Lotononis bainesii has been the outstanding legume in six pasture demonstration trials on poor hillside soils near Taree.

Temperate grasses.—*Phalaris tuberosa* is an adaptable grass, and the commercial cultivar has been sown widely in N.S.W. Research is indicating the suitability of other phalaris cultivars for certain environments. For example, at low rainfall sites near Dubbo, Temora, and Leeton, Sirocco has been more persistent and more productive than Australian Commercial. At Cowra A.R.S. the highest yielding of a range of cultivars was Siro 1146 (*P. tuberosa* x *P. arundinacea*). Phalaris hybrids have proved outstanding under irrigated and non-irrigated conditions at Leeton A.R.S.

In 1971, at Leeton A.R.S., the growth of phalaris/white clover mixtures was as good as or better than the growth of pure phalaris swards fertilized with nitrogen at the rate of 200 lb N/ac/yr—amply demonstrating the need to include a legume with grass. On lucerne/phalaris mixtures at Leeton A.R.S., lucerne has provided valuable feed during summer when phalaris growth is retarded.

Brignoles and Currie cocksfoots (*Dactylis glomerata*) are known to be useful alternatives to phalaris on the Western Slopes, and tall fescue (*Festuca arundinacea* cv. Demeter) is valuable in districts where summers are usually moist (e.g. Armidale, Jerangle). At Berry, early and late maturing ecotypes of Kangaroo Valley perennial ryegrass have been differentiated. These selections may eventually be released commercially.

Tropical and sub-tropical grasses.—At Grafton A.R.S., the range of grasses suitable for the North Coast region is being expanded. Cultivars of cocksfoot, *Sporobolus* and *Paspalum* are under preliminary observations in nursery rows. Seed yield data and photographic records were collected from twenty-four selections of kikuyu grass (*Pennisetum clandestinum*); the four best will be vegetatively increased. Also, seed of three paspalums and the "Breakwell" strain of kikuyu were increased during the past year. Advanced testing under grazing of three paspalum selections (*P. notatum* p. 1308, *P. notatum* "Pensacola", and *P. nicorae* p. 7627), each in association with white clover, has begun.

At Wollongbar A.R.S., the practice of autumn saving of herbage for use in winter is being studied with three grasses, kikuyu, *Setaria anceps* cv. Kazungula and pangola grass (*Digitaria decumbens*).

Tropical pasture species are being evaluated for the Manning River area of the North Coast. The tropical grasses broadleaf paspalum and Kazungula setaria, and the tropical legumes desmodium and lotononis, appear suitable.

Forage Crops

Work with many varieties of grazing oats at Berry has indicated the generally superior yield and quality of Saia oats on the South Coast. In 1971, on cultivated or chemically prepared seed beds, forage crop yields were ranked: Saia oats: Kangaroo Valley ryegrass: Wimmera ryegrass: barley and rye-corn: Priebe prairie grass and Algerian oats. However, on sites where crops were sod sown into a slashed paspalum sward, ryegrasses produced as much or more herbage as Saia oats over the whole winter season. All species yielded less when sod-sown than when sown on a prepared seed-bed.

Clare subterranean clover sown early (March) at high rates is promising as a winter forage crop for the Manning area.

WEEDS OF PASTURE

Ecological Studies

Ecological control.—Nodding thistle, *Carduus nutans*, has recently been introduced to the northern tablelands and is a potentially important weed of the area. The effect of various fertilizer and grazing treatments on this species in phalaris, white clover pastures is being examined. The possibility of high intensity rotational grazing as a means of controlling galvanised burr, *Bassia birchii*, in lucerne, in the central west, is also under study.

The Department has recognized the increasing importance of grasses of low nutritive value as weed problems. The control of barley grass, *Hordeum leporinum*, by grazing management, is being investigated at Trangie A.R.S., while at Wollongbar A.R.S. the feasibility of modifying the botanical composition of carpet grass, *Axonopus affinis* pastures by the use of fertilizers or introduced white clover is being examined.

Autecological studies.—Two major autecological projects, where the life history of specific weeds is under investigation have been undertaken with the co-operation of universities. The germination and growth of galvanised burr is being studied in a co-operative project with the University of Sydney. Laboratory and glasshouse experiments have been complemented by field studies at Nyngan and Gulargambone. Data to hand indicates possible means of control by grazing management and ploughing in some areas.

The life cycle of nodding thistle is being examined by an officer seconded to the University of New England. Preliminary results show the presence of a dormancy factor in seeds and a lack of growth responses to high fertility.

Chemical Control

Herbicides alone.—Field trials in western areas have confirmed the previous recommendation of 2, 4-D ester as the most suitable herbicide for galvanized burr control. The control, by herbicides, of bracken, *Pteridium esculentum*; docks, *Rumex* sp.; and grass weeds in lucerne are current projects. Research work on serrated tussock, *Nasella trichotoma*, is continuing with experiments on the use of solid forms of herbicide which can be accurately placed from the air.

Herbicides and pasture.—Increasing attention to the use of herbicides as ecological tools is a feature of recent Departmental research. The use of herbicides with pasture is being examined in relation to the control of nodding thistle on the northern tablelands and St John's wort, *Hypericum perforatum*, on non-arable central tablelands areas.

INSECT PESTS OF PASTURES AND FORAGE CROPS

Amnemus Weevil

Amnemus quadrituberculatus is a widespread pest of both temperate and tropical pasture legume species on the far North Coast. An ecological study of the pest is now concentrating on the causes of larva mortalities in the field. First instar larvae have been shown to prefer temperatures in the range 24–26° C and soil moistures near field capacity. Despite these preferences, larvae are tolerant of high temperatures and low soil moistures. Mark-release methods of estimating adult weevil numbers were found to give a more reliable estimate of males than of females.

In a series of trials, presowing soil treatments with either dieldrin or heptachlor at 1 lb/ac active ingredient have given good *Amnemus* control for the first 3–4 years of the pasture. Thereafter, legumes disappeared from trial areas, apparently as a result of overgrazing and adverse weather conditions. There is as yet no economic method of controlling the weevil in established legume pastures.

Plague Locust (Chortoicetes terminifera)

In 1971, a large area of N.S.W. and Victoria was menaced by a massive outbreak of locusts from egg-beds scattered over some 20,000 sq ml of country in the West and North of N.S.W. The most intensive control campaign ever organized in Australia was put into operation and was ultimately successful. Much of the information needed to control the outbreak was available from a continuing research programme on locust ecology based on the Rydalmere B.C.R.I. Emphasis has been on the development of techniques of spraying, insecticide evaluation, swarm movements and locust flight behaviour.

A series of insecticide trials conducted in spring 1971, indicated that fenitrothion provided the most effective control of swarms of hoppers and adult locusts.

Noctuid Caterpillars

Techniques of producing caterpillars of the economically important armyworm, budworm, cutworm and false looper species, using an artificial diet instead of the natural food, are being developed at the Rydalmere B.C.R.I. to facilitate the bioassay screening of insecticides under controlled laboratory conditions. A limited amount of bioassay screening was carried out, and this is to be expanded as culturing methods are improved.

Lucerne Bud Mite (Aceria medicaginis)

Preliminary investigations have shown no relation between the number of mites on lucerne plants and the severity of witches' broom disease symptoms. The overall economic significance of lucerne bud mite infestations is not yet clear. They are commonly found in low numbers on healthy lucerne stands in many areas of New South Wales.

Sitona Weevil

Sitona humeralis feeds on the foliage of legumes, particularly lucerne, sometimes causing a moderate loss of yield. A survey during the year indicated that no significant change in the distribution of the weevil has occurred since 1970.

DISEASES AFFECTING PASTURE SURVIVAL

Plant pathologists from the Rydalmere B.C.R.I. are investigating several diseases that are currently reducing the yield and density of improved pastures in parts of N.S.W. Of particular importance is the work on root disease of subterranean clover pastures where seedling losses have been shown to be particularly high. Since the disease organism has demonstrated an ability to survive on a range of pasture species, its elimination may be difficult. Further trials to determine suitable fungicides and to test the resistance of new subterranean clover lines may provide the required control measures.

A similar approach is being adopted with "yellows" in lucerne. A survey on the economic importance of this disease is continuing, and studies are to be made on the pathogen, host range, vectors, and possible control measures.

LIVESTOCK AND LIVESTOCK PRODUCTS

SHEEP AND WOOL

Grazing

The performance of grazing livestock depends on the quantity and quality of available feed. Both pasture supply and livestock demand fluctuate with season. The factors operative within this complex grazing system are being studied in experiments at research centres throughout the State to elucidate the principles involved. Once defined their application will lead to more efficient and economic pasture use.

Stocking rate experiments on natural pasture.—At Trangie A.R.S., Merino ewes were grazed on each of two natural pastures, one a perennial type and the other containing mainly annuals, at 1, 1½, and 2 ewes/ac. Ewe liveweights were highest overall on the annual pasture type, but were decreased by increasing the stocking rate. Stocking rate did not affect ewe liveweight on the perennial pasture or lamb growth rate on either pasture.

Stocking rate caused a change in the botanical composition of the natural annual pasture. Barley grass was a major component at the lowest grazing intensity while medics and other broadleaf species flourished under the higher stocking rates. Heliotrope density also increased under heavy grazing.

At Tamworth A.R.S. the high potential carrying capacity of natural pasture topdressed annually with 2 cwt/ac of sulphur fortified superphosphate fertilizer was demonstrated. Annual medics were a major component of the pasture which successfully maintained four Merino ewes/ac without supplementary feeding. The experiment is located on deep arable soil and it is likely that optimum stocking rates will be lower on less favourable parts of the North West Slopes. During the year action was taken to extend the investigations to include three different natural pastures in the region.

Stocking rate experiments on improved pastures.—At Condobolin A.R.S., research has shown that more sheep can be maintained on Jemalong barrel medic pastures than on natural pastures. Subsequently the effect on the carrying capacity of a lucerne-Jemalong barrel medic pasture of three rates of superphosphate nil, 112, and 224 lb/ac has been studied. Stocking rates were 1·5, 2, and 2·5 dry sheep/ac.

An increase in stocking rate caused a reduction in wool yield per head, increased yields per acre and augmented the hand feeding requirement. Pasture production increased with the low level of applied superphosphate with no further response at the higher rate. At the lowest stocking rate each superphosphate application rate increased wool production per head and per acre but at the two higher grazing intensities no wool yield response was evident. Hand-feeding was necessary at 2 and 2·5 dry sheep/ac. The sheep on the fertilized pasture needed 50 per cent less grain than those grazing unfertilized pasture.

Soil tests for available phosphate revealed a strong concentration in the 0·0–0·8 in zone. Under high fertilizer applications there was a movement of phosphate into the 0·8–1·6 in layer. There was no effect below 1·6 in under any treatment. The results are of particular interest in that they tend to confirm other work at Condobolin which shows that topdressing pastures with superphosphate on red earth soils in a low rainfall region is an inefficient method of supplying nutrients to pastures.

At Trangie A.R.S., an experiment was commenced in autumn 1970 to assess the ability of Jemalong barrel medic to persist and contribute to animal production in an area where soil fertility is naturally high. Stocking rates are 1·25, 1·75, 2·25, and 2·75 breeding ewes/ac. Wool production increased with each stocking rate from 8·7 lb/ac at the lowest grazing intensity to 16·0 lb/ac at the highest. Sheep liveweights were particularly stable due to the quality of the available dry feed including seed-pods of barrel medic. However, supplementary hand feeding was necessary to arrest declining body weights in late pregnancy at all levels of stocking. Despite poor burr production during two adverse seasons Jemalong barrel medic has continued to be a significant component of the pastures by virtue of its reserves of hard seed. The burr was not a serious contaminant of wool and sheep were run at levels above those normally found in the region.

Lambing time as a factor in grazing management.—The effects of variation in lambing time on wool and lamb production were studied at Wagga A.R.I. Sheep used were Border Leicester X Merino ewes mated to Dorset Horn rams, and the pasture initially consisted mainly of subterranean clover. Spring lambing percentage was higher than winter lambing percentage. The difference was as much as 30 per cent between May/June and August/September lambing. Furthermore spring lambs had higher growth rates. Mean growth rates for winter and spring lambs were 0·62 and 0·68 lb/d respectively. A reduction in wool and lamb production per sheep was caused by increased stocking rate.

Grazing for lamb production, Grafton.—In a grazing study at Grafton A.R.S. it has been shown that sheep production on the North Coast is technically feasible with good lambing percentages and good lamb growth rates. Border Leicester cross Dorset/Merino lambs performed better than Border Leicester cross Merino lambs. However, with the prices for wool and lamb prevailing at the time of the experiment sheep production was judged to be an uneconomic alternative enterprise for this area of the State.

Special purpose pasture.—The replacement of part of a subterranean clover pasture or natural pasture with lucerne at Wagga A.R.I. and Trangie A.R.S. respectively failed to increase animal production above that of set stocked pastures. The introduction of special purpose pastures leads to an intermittent grazing system and this was associated with retrogressive changes in the botanical composition of the pasture. At Wagga A.R.I. the set stocked treatment maintained the subterranean clover component of the pasture while in the lucerne substitute system the less desirable species silver grass, skeleton weed, and cape weed became dominant.

At Temora A.R.S. 12½ per cent of a lucerne-subterranean clover pasture was replaced with a like-sized area of Sirocco phalaris/subterranean clover in an attempt to increase animal production in winter, when there is a feed shortage. Only a marginal increase in wool yield and ewe liveweight occurred.

Similarly, at Leeton A.R.S. no benefit was obtained from an area of either paspalum/white clover, or sod-sown oats used with a base pasture of wimmera rye grass and subterranean clover.

Lucerne management.—Grazing experiments at Wagga, Temora, Cowra, and Tamworth Agricultural Research Stations have as their objective the development of systems of rotational grazing to:

- ensure lucerne survival under grazing;
- increase winter production through the retention of associate winter annuals;
- study the growth pattern of lucerne in relation to sheep requirement.

Stocking rate effects were recorded in lamb growth rate, wool production and ewe liveweight. Few differences were observed when the number of paddocks in the rotation sequence ranged from 3 to 9, provided each lucerne paddock was spelled for 36–40 days. A small decline in lucerne plant density occurred in three and five paddock systems but this was accompanied by the development of large crowns on the plants remaining and increased production of volunteer annuals between them. The lucerne did not persist under set stocking, although in the short term, lamb growth rate was favoured by this practice.

Comparison of pasture types.—At Temora A.R.S., Merino ewes at 3/ac on lucerne/subterranean clover pasture grew 3 lb/head more wool than sheep at the same stocking rate on Sirocco phalaris/subterranean clover and Wimmera ryegrass/subterranean clover pastures. Throughout the year the ewes also maintained a liveweight advantage of no less than 10 lb/head over those on the other pastures. At Trangie A.R.S. the performance of ewes grazing lucerne was superior to those on natural pastures.

At Wagga A.R.I. lucerne was again the superior pasture provided winter annuals were retained. Without associated winter annuals it was the poorest pasture in terms of animal production being surpassed by the Sirocco phalaris/subterranean clover and Wimmera ryegrass/subterranean clover pastures. Liveweight of sheep on the latter pasture mixtures was poor over summer and autumn but better than lucerne in winter and spring.

Feed quality rather than quantity was the important factor. This was demonstrated at Trangie A.R.S. where ewes and lambs grazing lucerne had better liveweights and growth rates respectively than those on natural pasture.

Integration of forage crops with pastures.—Grazing cereals, especially oats, are the common forage crops used to provide additional winter feed in the southwest wheat belt. Managerial decisions on animal movement assume considerable importance in such pasture/forage crop systems, and it is difficult to achieve optimum utilization of the herbage produced.

In a replicated experiment at Wagga A.R.I., Border Leicester X Merino ewes were grazed at two stocking rates on paddocks containing subterranean clover pasture only, or on paddocks where oats and lucerne each replaced 25 per cent of the subterranean clover pasture. Lamb growth rates of both spring and autumn born lambs, as well as wool production of ewes, were inferior to those set stocked on subterranean clover pasture. A good return from the grain produced at the low stocking rate of 3.2 ewes/ac failed to compensate for the reduced return from lambs.

Grazing oats as a supplement to lucerne and subterranean clover pasture is under evaluation at Temora A.R.S. The crop is grown on an additional area equal to 12½ per cent of the pasture area. Under dry seasonal conditions no advantage accrued to animals grazing the cereal.

The effect of various grazing systems using pasture and oats on the performance of pregnant ewes and yield of oat grain were examined in a joint project with CSIRO at Canberra. Inclusion of oats in a grazing system improved the liveweight gain from 2.4 lb/head/8 weeks on pasture, to 25.3 lb/head, where 15 ewes/ac were rotationally grazed. Oats had little effect on reproductive performance, but increased lamb survival compared with that on pasture. Grazing reduced grain yield, from 1,890 lb/ac ungrazed to 184 lb/ac after grazing at 40 ewes/ac for 4 weeks. Hence in a year like 1971, the inclusion of oats in a grazing system was biologically advantageous to sheep, but detrimental to grain yield.

A major research project was initiated in 1971–72 to study the use of forage crops to fill the winter feed gap on the Northern Tablelands. The two crops rape and oats were selected for initial evaluation. Preliminary results with rape indicate an absence of objectionable flavours previously found in meat from sheep grazing Rangi rape in winter. Consumer evaluation showed no clear difference in preference for ryegrass or rape fed sheep meats.

For many years the forage sorghums have been looked upon as a supplementary feed source for summer and autumn and claims have been made for their potential as a feed for young growing animals. Results from an experiment at Tamworth A.R.S. showed that Sorghum alnum and Sudax are unsuitable forages for growing sheep but satisfactory for maintaining mature animals.

Feeding supplements to grazing sheep.—A collaborative study between scientists of the Department and CSIRO on the strategy of feeding supplements to grazing sheep sought to define the optimum strategy for supplementing the diet of grazing sheep during winter stress on the Northern Tablelands. The experiment incorporates two feeding times, two feeding methods and two stocking intensities. Lucerne chaff was the supplement fed.

Analysis of the results revealed that only stocking rate had a significant effect on clean wool production. These results are similar to those obtained earlier and show that there is little advantage in terms of contemporary animal production from supplementary feeding of grazing sheep.

Simulation of grazing systems.—The aim of a collaborative study with the CSIRO Division of Plant Industry, Canberra, is to develop a simulation model relating animal production to seasonal feed availability in order to predict the benefits that a sheep producer might derive from controlled grazing management.

Genetics and Breeding

Selection for production characters in Merino sheep.—The single character selection flocks (selected for and against clean fleece weight; crimp number; weaning weight; fold score and face cover) which have been maintained at Trangie A.R.S. since 1951 are to be disbanded except for the *fleece weight* flocks which are required for examination of the selection plateau. For each pair of flocks the direct responses to selection and the correlated responses in other production characters have been analysed and published, or are in preparation for publication.

The 1971–72 results are in general agreement with the trends which have developed in these flocks over the last 20 years. In most cases direct selection responses have been asymmetrical although correlated responses have been fairly uniform in both direction and size. For example, increased fleece weight in the *fleece plus* flock has been associated with decreased crimp number, and in the *crimps minus* flock the decrease in crimp number which has occurred, is associated with an increase in clean fleece weight.

Fleece plus flock.—At Trangie A.R.S. an animal house experiment has been completed in which the efficiency of wool production of *fleece plus*, *random* and *crimp minus* ewes were compared at one level of intake. This experiment failed to substantiate the hypothesis that the observed plateau in response to selection for clean fleece weight is due to reduced variation in wool growing efficiency.

Weaning weight plus and minus flocks.—In recent years sheep from these flocks have been used in studies examining the value of Merinos as meat producers or as prime lamb mothers. A study at Condobolin A.R.S. has shown that the groups of first cross ewes derived by mating Border Leicester rams to *weaning weight plus* and *weaning weight minus* ewes are both highly fertile. In the second phase of the experiment the higher growth potential of lambs and the greater milk production of the ewes has resulted in a 5 per cent advantage for prime lambs from the Border Leicester cross *weight plus* ewes when they were mated to Dorset Horn rams.

Nucleus and stud flocks.—The Trangie *nucleus* flock which is selected on production records to achieve maximum wool weight while maintaining crimp frequency and encouraging maximum fertility, continues to produce more wool and to have a higher percentage of lambs weaned than the stud flock which is selected along traditional classing lines.

Fertility flock.—This flock, developed at Trangie A.R.S., combines high clean fleece weight with high bodyweight, low fold score and face cover, and a particularly good lambing performance. These qualities suggest that the *fertility* flock has potential as a dual purpose sheep. They have therefore been included in a breed comparison at Shannon Vale N.S., which includes two other Merino strains bred for dual purpose characteristics. The early results favour the *fertility* ewes in that they have weaned considerably more lambs than Cormo ewes (Corriedale X Saxon Merino from Tasmania), Fonthill ewes (Saxon X Rambouillet Merinos from Goulburn, N.S.W.) and Merryville fine-wool Merino ewes. The growth rate of lambs favoured the *fertility* and Cormo flocks.

Reproductive performance in the Trangie flocks.—An overall study of fertility within the selection flocks at Trangie has confirmed the undesirable association between a high degree of skin fold and low fertility. However, a possible association between fleece weight and fertility has been disproved. Overall there has been little difference in fertility resulting from selection for or against characteristics such as fleece weight, crimp frequency and weaning weight. Taken over all flocks, reproductive performance showed a pattern of increase with age up to 4.5 years, and then a subsequent decline.

Border Leicester breeding.—The Border Leicester flock maintained at Cowra, A.R.S., is being studied to collect basic information on the genetic parameters applicable to this breed. The 1971–72 lambing results were adversely affected by drought conditions which necessitated hand-feeding. However, the past pattern of a high proportion of dry ewes, high fecundity of lambing ewes and poor lamb survival rate were all evident.

There is now good evidence to suggest that some Border Leicester flocks are more susceptible to pneumonia than others. For this reason a means of identifying susceptibility to pneumonia in the live animal is being sought as an aid to selection against this undesirable trait. The value of chest X-ray is being explored.

An experimental Border Leicester flock established at Cowra A.R.S. included two strains susceptible to pneumonia, and one strain known to be resistant. Additional genetic material was added in subsequent years. Observations on this flock indicate no relationship between the incidence of this disease and the results of tests for *Chlamydia* sp., adenovirus, or glucose-fermenting *Mycoplasma*. Pathological evidence suggests that the disease is similar to the atypical pneumonia of sheep described in Scotland.

Hybrid vigor in the Border Leicester cross Merino cross.—Because of the great importance of the Merino as the basis of the first cross industry and as Border Leicester rams are currently the most popular sires for this purpose, a detailed study of the value of heterosis in progeny derived by crossing the two breeds has been carried out. The conclusion of these studies was that because of the high level of heterosis observed, it was better for the lamb industry that first crossing continue rather than that an inbred halfbred be developed using the two parent breeds.

Dorset Horn breeding.—Flocks of purebred Dorset Horns are maintained at Cowra A.R.S. for the study of genetic parameters in this breed. The effect of selection for growth and fertility in both spring and autumn is being studied, as is the overall problem of dystocia. A study of the anatomy of Dorset ewes has revealed that their pelvic cavities are markedly shorter and smaller in cross-sectional area than those of Border Leicesters. As such a characteristic is probably closely associated with the dystocia problem, related measurements of the frame are being considered which might make selection against small pelvic cavities possible in the live animal.

Comparison of prime lamb mothers.—A study at Glen Innes A.R.S. has shown that Dorset Horn cross Merino ewes are more productive than Border Leicester cross Merino ewes for lamb production when joined for an autumn lambing. There is little difference when spring born lambs are produced.

Comparison of sires for lamb production.—First cross lambs produced by crossing Dorset Horn rams with Merino ewes were slightly superior in terms of carcase weight and carcase grade than lambs from similar ewes sired by Border Leicester rams. With second cross lamb production, the evidence suggests that the breed of sire should differ from the breeds used in producing the first cross ewe—e.g. Dorset sire, on Border Leicester cross Merino gives better results than Dorset sire on Dorset cross Merino.

Comparison of Merino and dual purpose strains.—Two Merino strains and three dual purpose breeds are being compared in a study at Temora A.R.S. The BLM (Border Leicester cross Merino fixed halfbred developed at Condobolin A.R.S.) and Corriedale have consistently weaned more lambs than either Peppin Merino, Bungaree Merino, or Polwarth. Prewaning growth rates have favoured the BLM, Corriedale and Bungaree Merino.

Reproduction and Fertility

The ram.—A series of studies is being undertaken to determine the extent to which ram infertility contributes to reduced reproductive performance. These studies have highlighted the importance of social dominance within a breeding situation, as only when a highly dominant ram is infertile is it likely there will be any marked reduction in lambing results from a flock mating.

The ewe.—Two of the main factors being studied in relation to the fertility of the ewe are nutrition and liveweight at joining. Studies at Leeton A.R.S. continue to emphasize the importance of liveweight at joining on fertilization rate. Although liveweight has had little effect on the level of embryo mortality either early or in the middle of the sexual season, there is a suggestion of a higher embryo mortality in ewes undernourished during the first 3 weeks after service.

The early identification of ewes bearing twin foetuses is being attempted as a co-operative study with the CSIRO Clunies-Ross Laboratories, Prospect. Although pregnant ewes subsequently giving birth to twins have a higher plasma level of progesterone than ewes bearing a single foetus, the variation between animals will probably make this technique unsatisfactory for commercial use.

Another series of techniques, which have as yet proved unsuccessful, are aimed at increasing reproductive potential by rejoining ewes soon after lambing. To date neither the early removal of lambs nor the use of steroids has been successful.

The value of twin born lambs has been closely studied on the properties of several co-operating graziers. Single born ewes were approximately 27 per cent and 15 per cent heavier than twin born ewes at marking and weaning, respectively. By 18 months of age the difference in liveweight was negligible. Wool production of single born ewes was 20 per cent greater at lamb shearing, and 6 per cent greater at 18 months, with the advantage becoming negligible at later shearings. The reproductive performance of twins tends to be greater than that of singles.

Management strategies.—A mathematical model of reproductive wastage in ewes, describing the relationship between behavioural, physiological, and environmental factors limiting fertility in a paddock joining system is being constructed. This model is being considered as a tool in indicating at what points action is required by graziers in their efforts to reduce wastage, or at what points further research is required.

Studies are continuing to evaluate differences in ram percentages in a mating flock under a variety of feed, weather, and topographical conditions. Effect of mob size, relative ages and experience of both ewes and rams, and particularly the premating and mating husbandry associated with maiden ewes are all receiving attention.

Feeding and Nutrition

Drought feeding.—Earlier studies from Trangie A.R.S. showed that sheep receiving an oats diet grew up to 30 per cent more wool than those receiving a wheat diet of apparently equivalent nitrogen and energy value. Also, sheep fed cottonseed meal with their grain diets grew more wool than those receiving equivalent amounts of peanut meal. In a follow-up experiment it was found that wool growth responded to additions of cottonseed meal until the crude protein content of the diet approached 30 per cent (about 25 per cent of diet as cottonseed meal). Formaldehyde treatment of the cottonseed meal had only a very small effect on wool growth of the sheep. At present the poor response to wheat feeding is being intensively studied in a series of experiments in which sheep are fed diets containing varying proportions of wheat and oats.

The importance of buffers and salt in determining the intake of whole grain in sheep is being investigated at the Glenfield Drought Research Unit. It appears that the presence of sodium ion is essential for high levels of intake to be maintained, but that buffers as such do not appear to have any particular benefit. The recommendation which has arisen from this work is that 1.5 per cent of salt be included in a whole grain ration. Initial tests have indicated that there may be considerable variation in the sodium content of grains, and currently a detailed survey is underway to determine the sodium content of wheat and oats samples from throughout the State.

Various other aspects of survival rations are receiving attention in projects currently in progress. For example, in one experiment it has been demonstrated that feeding a mixture of wheat and saw-dust plus molasses and urea could save approximately half the wheat consumption needed for survival feeding. Several studies have failed to show any value of cracking grain in survival rations and there has been no definite response to the treatment of grain with formaldehyde. One observed consequence of prolonged feeding of a whole wheat diet was a marked reduction in serum and liver concentrations of vitamin A. Provision of vitamin A restored plasma vitamin A levels, but liver concentrations remained low while wheat feeding continued.

Supplementary feeding.—The field of supplementation of sheep at pasture has received further study without marked success. Neither urea nor biuret proved effective as a supplement to pasture on which unsupplemented sheep were either maintaining weight or losing weight at the rate of 1.7 oz/d. The need for supplementation is often hard to determine and several parameters have been considered as possible indicators. One such biochemical parameter being investigated is serum alkaline phosphatase.

Production feeding of weaners.—Poor seasonal conditions, particularly during the last 2 years have added interest to the needs and problems of growing weaners. In studies at the Glenfield D.R.U. good growth rates under full hand-feeding conditions have been observed. As with drought studies, there appears to be no advantage for cracking grain. Sorghum is one of the grains which has been closely studied, and it has been found that diets containing a high proportion of sorghum can be introduced quickly to young weaners without any set back in bodyweight. The best combination of sorghum grain and roughage has been a 70 to 30 mixture. On the other hand, similar experiments have indicated that a 60:40 combination is better in the case of wheat and roughage. In studies with whole wheat diets it was observed that grain alone was not nearly as effective as an 80 per cent wheat: 20 per cent roughage mixture.

Chemical Shearing

In recent years there has been considerable interest in the possibility of chemical shearing as a means of reducing labour costs. The results of experiments at Tamworth A.R.S., indicate that while chemical shearing is technically feasible, the employment of the practice in the industry is limited by the need for a well-designed and cheaply produced sheep coat. A major commercial evaluation of a plastic sheep coat was commenced in 1971.

Disease

Internal parasites.—In three successive years, observations have been made on lambs grazing irrigated pastures at Berrigan. *Nematodirus* and *Trichostrongylus* spp. were present in late summer and autumn, and *Haemonchus* occurred in pathogenic numbers in late summer of one year.

Studies are also in progress with ewes at Holbrook. Over the past 9 months only very low worm burdens have occurred under drought conditions. Serious parasitism occurred in spring on a Harden property where weaners are under observation. Both treated and untreated groups were affected by *Dictyocaulus*, *Ostertagia*, *Trichostrongylus*, and *Nematodirus*.

The causes of condemnation of 35 per cent of livers of sheep and cattle at twenty-three abattoirs over the past 4 years have been examined from Glenfield V.R.S. Approximately 80 per cent of livers condemned are due to parasitic infection by *Fasciola hepatica*, *Echinococcus granulosus*, or *Cysticercus tennicollis*. Total loss is estimated at \$500,000 per annum. Condemnations are highest in stock from the North Coast and Northern and Southern Tablelands.

Strains of *Haemonchus* and *Trichostrongylus* from goats have been shown to be resistant to thiabendazole from three of five properties investigated from Glenfield V.R.S. The position on the other two properties is still being examined. Resistance of these species in goats is similar to that demonstrated previously in sheep.

Sheep blowfly.—Work at the Rydalmere B.C.R.I. has covered many field and laboratory aspects of the problem of insecticide resistance and blowfly control. Jetting and larval implant trials have shown that all registered organophosphorus (OP) insecticides will provide adequate protection with thorough application. Chlorfenvinphos was most effective. Butacarb, the only carbamate registered for blowfly control, was considerably less effective.

Surveillance has continued with insecticide resistance in field populations of the sheep blowfly. All samples tested were OP resistant, but without increase above the levels reported in 1966. Dieldrin resistant flies are still abundant 14 years after its use was discontinued. Resistance to butacarb is widespread.

Genetical analysis of field strains selected for OP resistance was carried out in co-operation with the CSIRO Division of Entomology. A strain bred from one locality was the same as a composite strain both in the level of resistance achieved by subsequent selection and in the chromosomal location of resistance. No resistance has yet been detected in susceptible strains grown for up to twenty-four generations in the presence of sublethal and 50 per cent lethal doses of butacarb and carbaryl.

Research in association with the CSIRO Longpocket Laboratories, Brisbane, is involved with the electrophoresis of acetylcholinesterase extracted from OP resistant and susceptible strains of the sheep blowfly. A similar pattern of three enzyme forms has been demonstrated for each strain. Kinetic studies with diazoxon have revealed that these forms vary in their sensitivity to the inhibitor. As this variation could be a critical factor in insecticide resistance preparative electrophoresis is being used to separate the individual forms of the enzyme.

The value of several recommended procedures for sheep blowfly control is being examined in a Merino flock at Temora A.R.S. Mulesing at lamb marking has been of consistent value. Lamb shearing has helped in reducing body strike.

Mucosal disease virus.—An unusual condition in several flocks on the southwestern slopes has been studied. A relatively low incidence of affected lambs has been reported from several properties since 1964, the main features being hairiness of the birth coat, body tremors, and death of most cases within 2 or 3 months of birth.

Preparation from the tissues of two affected lambs were inoculated into pregnant ewes, producing abortion, or weak, hairy lambs. Mucosal disease virus was demonstrated in the initial tissue preparation, and also from aborted fetuses and weak lambs produced by inoculated ewes.

Clinical biochemistry.—The usefulness of biochemical measurement for the diagnosis of sheep diseases has been examined over a period of 3 years. Variability in various blood components has been established in normal flocks in relatively disease-free areas. The effects of breed, age, sex, and stresses such as pregnancy, lactation, transport, shearing, deprivation of feed and water have been examined, together with seasonal changes.

Pregnancy and lactation had little effect, but other stresses caused elevation of blood inorganic phosphate and the activity of enzymes traditionally associated with liver pathology. Effects on serum calcium were variable. Differences were observed between birth and 3 months of age, particularly in serum enzymes, proteins and values for the erythrocytic series.

Significant variations were recorded in activity of serum alkaline phosphatase (S.A.P.) particularly in young lambs, in which there was a sharp rise followed by a return to initial levels in the first 24 hours of life. This was found to be related to feeding, but not dependent upon colostrum, nor on fat concentration.

Further work has demonstrated a close correlation between change in body weight of growing sheep and the level of activity of S.A.P., and there is also an association between blood group and S.A.P. activity. Major differences have been found in the distribution of blood groups in different breeds.

BEEF CATTLE

Grazing

In an experiment at Grafton A.R.S. the success of a naturalized white clover pasture on shale soils was outstanding. Cows at nearly twice the stocking rate of unfertilized pasture maintained liveweights of 1,100 lb compared with 880 lb for cows grazing unfertilized pasture and 1,000 lb for cows grazing a mixed introduced legume pasture. The 185-day weaning weights of calves from the two improved pastures were 440 lb compared with 270 lb from unfertilized pasture.

An experiment has now been commenced to study the optimum rate of superphosphate to maintain soil fertility, pasture quality and production and animal production at Grafton. CSIRO Armidale and the University of New England have joined the Grafton team in a co-operative study to trace the phosphorus and sulphur cycles through the soil-plant-animal complex using double labelled radioactive superphosphate.

Pastures have been recently sown at Fineflower via Grafton to study beef cattle production from native and improved pastures on sandstone soils. Again CSIRO Armidale is co-operating in measuring the effect of pasture improvement and stocking rate on changes in the micro-fauna population and distribution.

The effect of nitrogen fertilizer on a mixed kikuyu, paspalum, carpet grass and white clover pasture was studied at Wollongbar A.R.S. Beef production was influenced by stocking rate and nitrogen fertilizer and was maximized at 1,250 lb/ac at a stocking rate of 4.3 steers/ac on pastures which received 570 lb N/ac.

At Glen Innes A.R.S. the emphasis has been on the supplementation of improved pastures during winter with grazing oats. Following weaning, steers grazed improved phalaris, cocksfoot, fescue and white clover pastures and during winter were allowed access to oats in four treatments: continuously; daily for 2 hours; for 2 days each week; no access. None of the groups with access to grazing oats gained weight any better than the groups grazing pasture only.

Nutrition

Experiments at Grafton A.R.S. have studied the growth restricting deficiencies of matured pastures of the Clarence Region. A technique based on volatile fatty acid production is being developed in co-operation with the University of New England to assess the value of matured pasture for promoting cattle growth. A mature native pasture was fed to cattle and some improvement in liveweight was obtained from urea and molasses supplements. The digestibility of the pasture was limited by factors other than nitrogen, phosphorus, or sulphur. Any liveweight increases resulted from increased feed intake.

The effect of urea/molasses supplementation of beef cattle fed mature carpet grass hay indicated that molasses supplementation decreased weight loss and increased dry matter intake and digestibility but no further responses were obtained from the addition of urea to the diet.

Phosphorus nutrition studies indicated that phosphorus supplementation of steers did not increase liveweight gain or digestibility of dry matter, energy or nitrogen although the digestibility and retention of phosphorus did increase. Bone phosphorus content was a more reliable estimator of phosphorus status than hair or blood phosphorus contents. An experiment indicated that the phosphorus intake of cattle may be predicted from the concentration of phosphorus in the faeces. An experiment is in progress, co-operative with the University of New England, to determine the effect of phosphorus supplementation alone, with urea/molasses or with linseed meal on the fertility of cows and liveweight gains of cows and calves.

Breeding

At Trangie A.R.S. the efficiency of selection procedures based on liveweight gain are being compared with traditional selection techniques in a long term breeding experiment. Early results indicate that selection of bulls by visual means may be a reasonably accurate method of improving liveweight gain, provided the assessors have this ideal in mind.

Economics

Economic prospects and the selection of strategies in farm development with pasture improvement and a build up in cattle numbers is being determined using computer analysis of research carried out by research workers at Grafton A.R.S.

The economic implications of a beef classification scheme are being examined through a cost/benefit study and by examining the relationship between prices received at the producer, wholesale and retail levels.

DAIRY CATTLE

Grazing

Nitrogen fertilizer for milk production.—The results of this work from Wollongbar A.R.S. have already had a considerable impact on dairying on the North Coast. Fertilizer nitrogen when applied to kikuyu grass has been shown to substantially increase carrying capacities and butterfat production.

Time of calving studies.—An experiment at Wollongbar A.R.S. showed that either spring or summer calving resulted in similar total lactation yields, but the shapes of the two lactation curves were quite different. Summer-calved cows produced at a higher level during early lactation.

Feed-year grazing experiments.—A 4-year study, comparing the productivity of a number of summer growing pastures on a monthly basis, has just been completed at Wollongbar A.R.S. The number of cows was adjusted weekly according to the pasture availability so that grazing pressure was equalized throughout the experiment. The results will enable a monthly prediction to be made of the pasture production, carrying capacity and butterfat production obtainable from a range of summer-growing pastures.

Environmental physiology of pasture growth.—Development of mathematical models to describe the spring growth of nitrogen fertilized pastures is being attempted on the Far North Coast. The models will be used to predict the response to nitrogen fertilizer applied under a wide range of conditions, and thus develop strategies to aid farmers in deciding when to topdress with nitrogen fertilizer.

Properties of tropical pasture species which affect cattle production.—Extensive studies have been conducted at Wollongbar A.R.S. to investigate the factors affecting feed quality in tropical pasture species. Quality has been shown to vary considerably both between species and on a seasonal basis, and can be influenced by length of regrowth and fertilizer application. Many techniques for measuring pasture quality are ill defined and there is a need to improve these indices.

Supplementary Feeding

Comparison of energy sources as supplements for grazing dairy cows.—In studies conducted at Grafton A.R.S., the type of grain fed was found to have little effect on the response to supplementation. In the short term the amount of milk being produced by a cow gave relatively no guide to how she would respond to supplementation.

Protected polyunsaturated lipid supplements for dairy cows.—This is a co-operative project with the CSIRO Clunies-Ross Laboratory, Prospect, and is aimed at determining the effects of feeding protected polyunsaturated lipid supplements on milk yield and composition. Results have shown that the concentration of linoleic acid in the milk fat could be increased markedly by feeding these supplements.

Breeding

N.S.W. Dairy Herd Improvement Programme.—A statewide programme, designed to increase the production efficiency of dairy herds through selective breeding, has been commenced. Herd improvement utilizes the techniques of herd recording and artificial breeding, and the two systems must be efficiently developed and integrated, to ensure maximal herd improvement on each farm.

Research at this stage is primarily advisory, but once the programme is implemented, considerable research will be required to ensure that net economic return to the farmer is maximized.

Measurement of Milk Production and Composition

Accuracy of sampling procedures for estimating lactation yield.—The effect of the frequency of measurement of milk production on the accuracy of total lactation yield estimates is being studied. Results to date indicate that the frequency of herd recording can be reduced to 3 to 5 tests at 2 to 3 monthly intervals in lieu of the present 10 tests at monthly intervals.

Calf Nutrition

Dairy beef production.—The rearing of crossbred calves by multiple suckling is being evaluated at Wollongbar A.R.S. as a supplementary enterprise for the dairy farmer. Results have shown that calves can be suckled at three per cow for the first 9 to 10 weeks of a dairy cow's lactation, then weaned and grown through to 10 months of age. The cow can be milked for the remainder of her lactation. This system should offer considerably greater returns than a straight dairy enterprise where cows are milked for the full lactation.

In the current experiment, post-weaning growth rates of calves were improved by reducing the stocking rate. Despite the use of low stocking rates, it does not appear that nitrogen-fertilized kikuyu grass can support high growth rates in early-weaned calves. Other results from this study indicate that there may be an advantage in using a Friesian (compared with Angus and Brahman) sire for dairy beef production.

Level and frequency of whole milk feeding.—At Wollongbar A.R.S., the level of whole milk fed to crossbred calves was shown to have a considerable effect on growth rate to, and rumen development at weaning (12 weeks). Rumen development was significantly less in calves fed high levels of milk. In a current experiment, there are indications that this poorer rumen development has an adverse effect on post-weaning growth rate.

In a trial conducted at Grafton A.R.S., it was demonstrated that the labour input in calf feeding could be substantially reduced by feeding calves once instead of twice daily. Twice daily fed calves grew faster up to 8 weeks of age, but from 8 to 26 weeks there was no difference in calf performance.

Bloat in young calves.—Bloat was observed (24 per cent incidence) in bucket fed calves at Wollongbar A.R.S., and was found to affect calves from about 3 weeks of age. Of those calves affected, some died at 3 to 4 weeks of age from acute bloat, whilst the balance affected survived but grew very poorly, usually bloating soon after feeding. It is thought that feeding management may be a predisposing factor.

Economic Studies

Economic survey of the dairy industry in N.S.W.—A survey was conducted to assess the cost and income structure of dairy farms in N.S.W. over the period 1967–68 to 1969–70, for the information of the Dairy Industry Authority and the Dairy Industry Prices Tribunal. Preliminary reports have already been forwarded to the Prices Tribunal.

Consumer demand for whole milk.—The major determinants of consumer demand for whole milk are being isolated in this study. The results will be used to predict future consumption patterns for milk at various price levels.

Whole farm studies.—Recording and analysis of farm management data has now been completed on the five remaining whole farm research projects on the Far North Coast. Productivity and net farm income increased substantially on all farms through the use of the new pasture and crop systems.

Optimum feed-year programmes for North Coast dairy farms.—A linear programming model has been developed to determine optimum grazing systems on North Coast dairy farms under a range of resource conditions. Using the model, the effects of changes in the availability of a range of resources on various farm plans synthesized by the model, are being studied.

DAIRY PRODUCTS

Machine Milking

The Richmond Dairy Research Laboratory is engaged in the development of standards of performance for milking machine components. A testing device has been developed to assess the performance of teat cup liners under simulated field conditions. Two published standards on vacuum regulators and end-of-milking indicators are being used to evaluate commercial equipment.

Dairy Hygiene

After several years work, the Standards Association of Australia is publishing standards on dairy detergents and sanitisers. To ensure that the Australian dairy industry will obtain the maximum benefit from these standards, the Australian Agricultural Council approved the establishment of the Commonwealth Advisory Laboratory on Dairy Detergents and Sanitisers at the Richmond D.R.L.

A major function of this Laboratory is to advise the dairy industry on the performance of the detergents and sanitizers used in its cleaning programmes. Another function of this Laboratory is the examination of the public health implications of the use of dairy detergents and sanitizers.

Work continues at the Richmond D.R.L. on the improvement of milking machine cleaning. Details of a superior cleaning system have been established and work is now in progress on improving the efficiency of the formulations being used.

The design of a new machine which will allow assessment of the cleaning of bulk containers under laboratory conditions has been completed. This cleaning simulator is now being constructed at Hawkesbury Agricultural College.

Preliminary work on a rapid method for assessing the hygienic condition of dairy factory equipment has been completed.

The use of "Bactostrip" as a quality control measure in commercial butter manufacture is being evaluated from Wollongbar A.R.S. Its performance with continuous butter manufacture has been satisfactory.

Quality of Manufactured Products

Butter.—At the Richmond D.R.L., a survey has been made of the copper content of milk, cream and butter. Trace amounts of this metal have been shown to catalyse the oxidative degradation of butterfat. The copper is introduced by contact between the product and equipment on the dairy farm or in the dairy factory that has exposed copper parts. The results show that a large number of the samples had excessive copper content. These results are being followed up by co-operative work between the research and field officers of the Department. This is part of the Department's programme generally aimed at monitoring and improving the biological and chemical qualities of butter.

Cheese.—The growth and longevity of *Escherichia coli* Type I in cheddar cheese has been investigated at the Rydalmere B.C.R.I. This organism is commonly used as an indicator organism for cheese quality. The number of viable *E. coli* organisms decreased during 5 months storage to a point at which none could be detected. The time taken for the disappearance of the organism in cheese is proportional to the initial numbers present in the milk from which the cheese was manufactured. These results are significant when interpreted in terms of the Public Health regulations on the degree of heat treatment required for milk used in cheese manufacture.

Cream.—The occurrence of "albuminous" flavour in raw farm cream is being investigated from Wollongbar A.R.S. Suggestions that this defect may be associated with coagulase-positive staphylococci bacteria have been experimentally discounted. Further work has shown that *Klebsiella aerogenes* may be involved.

The Development of New Dairy Foods

The aim of this project is to assist the dairy industry to diversify its products, by co-operating with dairy companies in the development of new dairy-based foods.

One prepared dessert product has been successfully developed with a N.S.W. dairy company and is expected to be marketed in the new financial year. Other new products are under current development.

In addition to the development of specific products, the group is co-operating with the Working Party on Milkfat Fractionation Research in the investigation of economic uses for milk fat fractions. One such study has been completed in which up to 15 per cent of the fat in processed cheese was successfully replaced by the hard milkfat fraction.

Another aspect of new food development being undertaken is a study of the behaviour of different milk components as part of an emulsion. Many of the foods being developed are emulsified products and some basic understanding of emulsions will greatly facilitate their development.

DISEASES OF CATTLE

Cattle Tick Ecology

Larval productivity.—Larval productivity is measured as the percentage of exposed eggs which are harvested as larval ticks. Results of a quantitative study of the cattle tick (*Boophilus microplus*) have established a seasonal pattern of 12 per cent productivity for July-September, 50 per cent for October-March and less than 5 per cent for April-June. Analyses are establishing relationships between productivity and environmental factors, namely temperature, rainfall and a measure of soil moisture.

Larval survival.—Preliminary analyses of data from larvae exposed at Wollongbar Cattle Tick Research Station and Tabulam indicated an apparently simple inverse relationship between temperature and larval longevity for each area separately. There was probably an interaction between air temperature and moisture for in the drier Tabulam atmosphere larvae died more rapidly than expected. At Wollongbar 95 per cent of larvae exposed in September, January and April died in 7.6, 6.0 and 8.6 weeks respectively when the mean temperatures for these periods were 19.4°C, 22.9°C, and 18.5°C. The corresponding figures for Tabulam were 6.4 (18.9°C), 4.4 (23.1°C) and 5.0 weeks (18.9°C).

Field study of tick generations.—A study was commenced at Wollongbar C.T.R.S. to determine the incidence and number of tick generations per year and the rate of increase. Five hundred adult ticks from the "spring rise" larval population were dropped in a paddock by a sampling herd sufficiently large to ensure subsequent maximal pick-up of emerging larvae. Counts of ticks on the animals showed a second generation of five thousand from mid-January till mid-March and a third generation of one hundred and fifty-five thousand from the end of March till mid-June. The phenomenal thirty-one fold increase from the second to the third generation indicated that in an uncontrolled field situation in favourable locations there would not inevitably be a scarcity of larvae in late winter—early spring when the fourth generation emerged.

Acaricide Application for Cattle Tick Control.

Methods of analysing field dip samples.—The early stages of a study to evolve and evaluate a bioassay technique of dunking ticks to determine if field dips are efficient gave promise that a reliable test will be evolved. There was little variation between tests and there were significant correlations between concentration of chemical and four measures of determining control. It was also found that time of immersion and temperature of incubation were critical factors in the success of the test while size of tick was not.

Efficiency of acaricides against resistant ticks.—The incidence of resistant ticks, particularly of the Biarra strain, has increased in the field. In the interests of security the breeding and testing of resistant material was not permitted at Wollongbar C.T.R.S. and joint trials were conducted by CSIRO and departmental staff at Longpocket Laboratories, Brisbane. Results showed that the two organophosphates, Ethion and Delnav, used commonly in N.S.W. were inefficient against Biarra ticks for the present policy of maximal control and for cleansing cattle for movement to clean country. The current acaricide of choice was an acid buffered mixture of Ethion (0.075 per cent) and Chlorphenamidine (0.04 per cent).

An investigation to determine dosage-response relationships of reference acaricides for use in trials at Wollongbar C.T.R.S. to predict the efficiency of candidate acaricides in simulated resistant situations has produced promising preliminary results.

Evaluation of candidate acaricides.—Exhaustive trials conducted on Ethion/Chlorphenamidine mixtures and Chlorfenvinphos showed that they were safe and economical, could be handled efficiently in dips and were very efficient against susceptible ticks. Data were analysed from fat residue trials done on Delnav in the previous year and on Chlorfenvinphos in this year. Biopsy sampling of subcutaneous fat was shown to indicate residue levels as reliably as post mortem sampling of subcutaneous and peri-renal fats.

Three treatments at 5 day intervals in Delnav produced maximal residues of 3.4 ppm on day 3 and the residues remaining after 32 days were still above the tolerance limit of one ppm.

Chlorfenvinphos residues degraded exponentially with half-lives of 0.7 and 0.3 days for adipose and milk samples with mean maxima of less than 0.5 ppm on day 1.

Rational Development of New Acaricides to Control Cattle Tick

Insensitive acetylcholinesterase constitutes the mechanism of acaricide resistance in the Biarra and Ridgeland strains of the cattle tick. This research programme, co-operative with CSIRO and based on their Longpocket Laboratory Queensland, is aimed at understanding the nature of this insensitivity, with a view to designing chemical structures for effective acaricides. It was reported previously that four fractions had been separated by chromatography of soluble enzyme extracted from resistant (Biarra) and susceptible (Yeerongpilly) strains. Acrylamide gel electrophoresis of these four fractions has now revealed that, in each strain, five forms of the enzyme are associated with these four fractions. Fractions 1 and 2 are single homogeneous forms of the enzyme which however behave differently from one another when electrophoresed.

Preparative quantities of these two forms have been produced. Kinetic experiments with the acaricide inhibitor coroxon have verified the homogeneity of the forms but no significant difference could be demonstrated for the sensitivity to inhibition of the two forms between the resistant and susceptible strains. The basic resistance mechanism of a 500-fold difference in sensitivity between the strains is associated with the other three forms of the enzyme. This work has enabled isolation of the actual acetylcholinesterase form responsible for resistance and to begin the programme of evaluating potential acaricide structure against this critical component. The organophosphate inhibitor paraoxon has been synthesised and will be used as the standard inhibitor molecule for structure activity studies, for the design of suitable acaricides.

Mastitis

The mastitis control programme.—This work was started in 1969 with 40 demonstration herds in which the response to a comprehensive control system is being assessed firstly by mastitis incidence, secondly by production, and thirdly by cost over 3 years. Mastitis incidence is determined by Rapid Mastitis Tests, bacteriological examinations of quarter milk samples and the number of clinical cases. Machine performance and milking management are monitored regularly and the cost of dairy requisites and antibiotics recorded.

Mastitis incidence has been reduced by over 50 per cent, most of the reduction occurring in the first year of the programme. Analysis of production and overall economic benefits is continuing. The information obtained is to provide a basis for an educational programme in mastitis control.

Individual control measures.—Research was conducted into the effectiveness of post-milking teat dipping at the Richmond Dairy Research Laboratory. When an iodophor teat-dip was used on three commercial dairy herds a 27 per cent reduction in the number of new mastitis infections was shown.

At Glenfield V.R.S., the effectiveness of dry cow therapy was evaluated using two commercial antibiotic preparations. Sixteen herds were examined and preliminary data suggest a cure rate of 75 per cent comparing infections prior to drying off, with residual infections at the next calving.

Excretion times for intra-mammary infusions.—Antibiotic preparations have been examined in four-cow excretion trials in work based on the Rydalmere B.C.R.I. Of the three products tested one was found to be acceptable from the viewpoint of speedy elimination for commercial milk usage.

Milk quality.—The yellow stain on the filter discs used to test raw milk for sediment, a major cause of milk rejection, has been investigated at the Glenfield V.R.S. It was found that the yellow stain was associated with mastitis, the colour being due to beta-carotene in the milk.

A rapid technique for routine determination of somatic cell counts has been developed at the Rydalmere B.C.R.I. This technique has been applied to 7,500 samples of milk to provide an indication of udder health as an aid to mastitis control.

Internal Parasites

Round worms.—Studies on the seasonal incidence of round worms of dairy and beef cattle have been progressively established in various areas of the State since 1964. Following the definition of importance and seasonal incidence in each area, programmes have been initiated to obtain information on economic methods of control, and the effectiveness of anthelmintic treatments.

On the Far North Coast, *Cooperia*, *Haemonchus*, and *Oesophagostomum* are important in dairy calves and dairy and beef weaners, effects being enhanced by winter malnutrition. Three winter drenches at intervals of 6–8 weeks increased liveweight of beef weaners in spring by 22–33 lb.

Dairy calves and weaners under intensive conditions require frequent dosing to control infections acquired during the summer months. Liveweight advantages of 0–45 lb or 10–55 lb followed treatments at monthly or fortnightly intervals respectively.

On the Northern Tablelands, *Cooperia*, *Ostertagia*, and *Oesophagostomum* were important in beef weaners, but *Ostertagia* and *Trichostrongylus axei* were found in yearlings and adults. Malnutrition and parasitism caused winter illthrift in weaners, and ostertagiosis caused poor performance in yearlings and adults in late summer-autumn.

Treatment in summer proved to be of limited value for control of *Ostertagia* infections but as a result of studies on populations of larvae on pasture, treatment in July, with movement to pasture spelled for 3 months or more, was shown to be effective in three consecutive seasons. Pasture studies revealed a marked increase of larvae in spring, and a high proportion of these became arrested in development after ingestion.

On the central Southern Tablelands and South Western Slopes, *Cooperia*, *Ostertagia*, and *T. axei* were important, and arrested development of *Ostertagia* larvae occurred in a similar pattern.

Flukes.—Observations on eight coastal and Tablelands properties revealed light to moderate burdens of 20–200 flukes during winter, as the result of ingestion from contaminated pastures in autumn. Response to treatment produced a difference of 20–44 lb liveweight in winter months only.

Brucellosis

Several methods for testing samples have been investigated at two laboratories to determine their accuracy and suitability for the purposes of screening the national herd for evidence of infection during eradication.

The complement fixation test was the most reliable for identification of infected animals. In animals shown to be infected, by culture of the organisms, the Rose Bengal, Crystal Violet, serum agglutination and milk ring tests were efficient, but false positive results were recorded. Inconclusive reactions occurred with serum agglutination and milk ring tests. Culture and serological testing of mucus were of little value for routine diagnosis, but use of the milk ring test on bulk milk samples from herds was valuable for the detection of infected herds.

Although the complement fixation test is the most reliable for individual animals, because it discriminates between infected and vaccinated reactors, it is not suitable for examination of large numbers by manual methods. However, autoanalyser operation could handle about 125,000 tests per channel per year, using one operator for 1 or 2 channels. Testing of this equipment is encouraging, but problems of a technical nature remain to be overcome before mass surveys are commenced.

Tuberculosis

Tuberculosis was confirmed in 158 of 217 specimens from cattle and 107 of 205 samples from pigs, following slaughter at abattoir and detection of lesions. The most common organisms from swine was *Mycobacterium bovis*, but serotypes of *M. avium* and *M. intracellulare* were identified.

PIGS

Nutrition of the Growing Pig

Minerals and vitamins.—Experiments at Wollongbar A.R.S. examined the responses of growing pigs to mineral and vitamin supplementation of practical pig diets fed under intensive conditions. A base supplement of vitamins A and D₃ was added to all the diets, as it is considered that a dietary source of these vitamins is essential for pigs raised under intensive systems.

Results of an earlier experiment indicated that mineral and vitamin supplementation of a wheat/meat and bone meal (plus fish meal in the early growth stages) diet was not necessary to produce sound pig performance. Additional analyses of the results revealed further significant differences, but these differences were small and of no practical importance as the cost of obtaining the improvement was greater than the return.

When soy bean meal formed the protein supplement to a wheat-based diet, there was a marked need for mineral supplementation. Five pigs which did not receive a mineral supplement failed to complete the experiment. The addition of vitamins had no effect but there was a sex by mineral interaction which showed that without a mineral supplement gilts did not grow as well as barrows, though both grew equally well when minerals were added to the diet.

With mineral supplementation of a sorghum/soybean meal diet there was again a very marked improvement in performance. There was no response to vitamins nor a sex by mineral interaction. The absence of this latter effect was possibly due to the very low level of minerals in the base diet such that the barrows lower requirements were not met.

A similar mineral response occurred when maize/soy bean meal was the base diet, and a vitamin response was also observed. It was felt that this was due to a deficiency of nicotinic acid. As with the sorghum diet there was no sex by mineral interaction.

The base diet for the final experiment was barley/meat and bone meal (with some fish meal during early growth). There was no response to mineral and/or vitamin supplementation of this diet, nor was there any sex interaction.

Work has continued on the evaluation of the laboratory rat as a test animal for mineral and vitamin nutrition of the growing pig. Results are not yet final, but it has been indicated that, with certain limitations, rat responses are very useful indicators.

Evaluation of sweet lupins.—Rat responses were used to evaluate the use of sweet lupin seed as a protein supplement for pigs. Initially, its value as a partial or total replacement for meat and bone meal was investigated. The results showed that sweet lupin seed meal is unsuitable as the sole protein supplement to wheat in diets for albino rats. However, it would appear that it can be used to replace up to 75 per cent (and certainly 50 per cent) of the protein supplied by meat and bone meal.

Reproduction

Departmental research workers located with the CSIRO Clunies-Ross Laboratories, Prospect, are investigating the possibility of using the hormone prostaglandin for synchronization of oestrus. To do this it is necessary to develop methods which enable studies of the presence and function of prostaglandin in the sow.

By the use of general anaesthesia it was found that catheters could be successfully placed in uterine veins of the sow. Analyses of blood taken at 3-hourly intervals through the catheters showed that prostaglandin could be assayed.

Carcase Grading

The feasibility of implementing a pig carcass grading system in Australia has been investigated. Because the requirements of individual processors differed so much it was concluded that there was no possibility of introducing a national grading system. However, a national measuring service was considered to be a feasible alternative and that such a service could be based on the system currently in use in the United Kingdom.

Recommendations made in the feasibility study report have led to the implementation of two co-ordinated research projects. One project aims to survey carcass measurements of pigs slaughtered at selected abattoirs throughout Australia. The second project will involve an economic assessment of the costs and benefits which could follow the introduction of a national pig carcass measuring service.

E.M.C. Virus Myocarditis

Substantial losses were caused by this disease in 1970-71, particularly in association with rodent plagues in the Central West and North Coast areas, and incidence was similar to that reported in North America in 1959 and 1960.

The virus was recovered and identified against a reference virus. Studies were carried out on dose rate, routes of infection and the pathological effects of the disease in pigs.

The virus was also recovered from wild rats on an infected property, but although it was shown that virus was excreted in the faeces of infected rats, pigs were not infected by such faeces at the doses used. Rats and mice were not infected by feeding rat faeces containing the virus, but rats fed heart muscle of infected pigs did show evidence of infection.

POULTRY

Breeding for Meat Production

The broiler breeding programme, commenced in 1959 at the Seven Hills Poultry Research Station, aims to provide estimates of genetic parameters of interest to broiler breeders and to investigate present and likely future genetical problems facing the broiler industry. One of the major studies associated with this project is an investigation being conducted into the inheritance of food efficiency in broilers and its relationship with growth rate.

In a multidiscipline investigation into leg weakness in broiler chickens, the main initial emphasis is on breeding a line of experimental chickens with a high level of susceptibility to this syndrome. Considerable research is also being conducted into nutritional, histopathological, and husbandry factors associated with leg weakness.

Breeding for Egg Production

Recent results from the egg-breeding programme at Seven Hills P.R.S. suggest that the considerable hybrid vigour for egg production in crosses between White Leghorns and Australorps is simply due to dominant gene action. It is likely that a small number of genes or genetic factors are responsible for this hybrid vigour and that the parent breeds carry very little, if any, independent genetic factors for egg production. If this is the situation, then Australian poultry breeders could be expected to be at a selection limit for egg production. An analysis of random sample laying test results over the last 5 years suggests that this is the case. An investigation into the food efficiency of the White Leghorn by Australorp crossbred has indicated that it is no more efficient than its parent breeds in converting food into eggs. However, the main advantage of this crossbred lies in its lower mortality and greater productivity per hen resulting in lower capital and labour charges per unit of egg produced.

The dwarf gene, obtained from the South Australian Department of Agriculture is being infused into the genetic background of the White Leghorn flock from the egg breeding programme. This will enable research to be conducted into the husbandry, nutrition, and economic value of dwarf versus normal sized layers.

Husbandry

Several investigations into the husbandry requirements of laying hens were commenced in 1971. These investigations include determining the optimum size, shape, and stocking density of egg-laying cages, a comprehensive investigation into the value of controlled environment housing for laying hens, and determining the optimum lighting pattern and force moulting pattern for laying hens.

Nutrition

Meat production.—Experiments examining the optimum stocking density of broiler chickens and the interrelationship between floor space allowance and dietary energy indicated that broilers could be economically reared at higher stocking densities than those in current commercial use. As some retail chicken markets require uniform size of dressed chickens for efficient operation, some broiler growing organizations are rearing the sexes separately to overcome the problem associated with the faster growth rate of male chickens. A project has therefore been commenced at Seven Hills P.R.S. to investigate the specific nutritional and environmental requirements of male and female broiler chickens when the sexes are reared separately. An investigation into the feeding of mash versus pellets and the interaction of this physical form of the diet with the energy concentration has indicated that pelleting the diet increased liveweight and improved food efficiency.

Research work into locally available sources of vegetable protein as a substitute for imported soy bean meal has demonstrated that soy bean meal can be replaced with up to 16 per cent lupin seed meal in pelleted broiler diets. An investigation into the optimum food restriction pattern during the rearing and laying periods of pullets from two commercial broiler female lines has indicated that a rearing restriction of between 40 and 60 per cent *ad lib* feed intake followed by *ad lib* feeding during laying is likely to be the best management practice. Continuing research was conducted into the factors associated with the quality of meatmeal protein and the range of variation in meatmeal quality.

Experiments were also conducted looking at the nutrient requirements of Australian White turkeys and of local Pekin ducks.

Egg production.—Nutritional experiments at Seven Hills P.R.S. with hens in cages and on deep litter measured the daily energy intake and diurnal variation of energy intake of White Leghorn by Australorp layers and the ability of these layers to regulate energy intake. Caged pullets were less capable of regulating their energy intake and overconsumed a greater amount of the high energy diets than pullets on deep litter. Productivity was not significantly altered when the protein level was reduced. Food restriction on a time basis reduced the intake of the high energy diet in most treatments. No major effects of diet on egg production or egg weight were observed although both these parameters tended to increase with the energy content of the diet.

An experiment conducted with hens on deep litter found age of changeover from a pullet rearing diet to a high calcium laying diet to have little effect upon egg production parameters during the first laying year.

In a project carried out from the Wagga A.R.I., the utilization of lupin meal in the diets of growing pullets and laying hens is being examined.

Selenium.—Several complex organo-selenium compounds, which are to be tested for biological activity, have been prepared at the Rydalmere B.C.R.I. Manufactured feeds are to be surveyed for selenium content to evaluate the possible need for selenium supplementation.

Determination of metabolizable energy.—The use of polyethylene as a marker in poultry food is being investigated at Seven Hills P.R.S. This new technique appears to be considerably superior to the usual marker substances in determining the relationship between food consumption and manure production. A laboratory method has been developed that recovers 99 per cent of ingested polyethylene from poultry manure.

Economics

A linear programming study was initiated at Seven Hills P.R.S. concerning the formulation of low cost poultry diets. This study indicated that the computer programme should set the limits of the various nutrients in terms of weight and not in terms of percentages of the total diet as is usually done. Some of the diets so formulated are being experimentally fed to growing pullets at Hawkesbury Agricultural College.

Research is continuing into the development of a supply analysis model for the egg industry. A linear programming approach has been adopted which attempts to take account of such factors as taxation, consumption, farmer objectives and time.

Disease

Mortality survey.—This survey of all mortalities in stock at the Seven Hills P.R.S. has continued over several years to provide basic information on incidence, epidemiology, and control of disease. Of a total population of 14,500 chickens, 2,659 deaths were investigated. Although the birds had not been vaccinated against infectious laryngotracheitis, there was no serious respiratory disease in the period. Despite vaccination against infectious bronchitis, losses from nephritis-nephrosis-uraemia syndrome were 19.6 per cent of the total mortality. Coccidiosis was responsible for 9.3 per cent of mortalities, and Marek's disease 10.2 per cent.

Marek's disease.—Following detailed study of the disease in a commercial flock in the United Kingdom, and experience at Cornell, U.S.A. a herpes virus of turkeys (HVT) has been isolated and tested as a vaccine in the Glenfield Veterinary Research Laboratory, on the Seven Hills P.R.S., and in a commercial flock. This vaccine and one produced from attenuated Marek's disease virus (MDV) have both been shown to reduce incidence and mortality.

Acute MDV isolated from flocks in N.S.W. was shown to have virulence similar to strains isolated in the United Kingdom and is not passaged regularly in chickens. Tissue culture techniques have been developed for the isolation of both MDV and HVT.

It has been shown that subsequent mortality is determined by infection during the growing period.

BEES

Breeding

A developing programme located at Hawkesbury Agricultural College is directed to the development of a superior strain of honey bee by encouraging selection within pure strains. The initial phases of the project are endeavouring to study the inheritance of a quantitative character, wing hook number, and the establishment of a correlation between this character and honey production. Results have shown that variance of wing hook number is high and unrelated to wing size.

Disease

The incidence of American Fowlbrood disease in bees is increasing in Australia. The causative agent *Bacillus larvae* has been known to contaminate honey and result in export rejections. A sensitive method of determining the incidence of *Bacillus larvae* in honey is being developed at the Rydalmere B.C.R.I.

RESEARCH IN BIOLOGY AND CHEMISTRY

VIROLOGY IN ANIMAL DISEASE

(see also sections dealing with individual livestock species)

Immunofluorescence in Diagnosis

The viruses of the swine fever-mucosal disease complex are important, as disease producing agents in pigs, cattle, and sheep. Detection by conventional techniques is often a lengthy and difficult process, not suitable for diagnostic application.

Investigation of the technique of immunofluorescence in a model system using Reovirus, has been extended to a system using mucosal disease virus in tissue cultures and immune bovine serum. Encouraging results have been obtained.

Detection of Adenovirus Group

A gel-diffusion precipitin test has been established, based on cell cultures of dog kidney infected with canine hepatitis virus, and antisera from rabbits. The antigenic activity which is specific for the group has been isolated from other components to give a specific reaction.

This test has been used in preliminary investigations into sheep pneumonia, and will have application in the investigation of other conditions of which the cause is not known.

Myxoma Virus Production

Improved methods of preparation have been introduced to avoid contamination of the laboratory environment, and to permit control of virus content in a standardized form, which conforms with modern requirements for live viral agents.

The relationship between rabbit infective dose and the laboratory count, on rabbit kidney cell culture, has been established. Experiments have shown that production from infected rabbits is preferable to production from cell culture.

NOXIOUS AND FERAL ANIMALS

Rabbits

This work involves the development and evaluation of new rabbit control techniques in various areas of the State.

Rabbit bait comparison trials.—During the year two trials comparing pellets and carrots were completed from the Glenfield Noxious Animals Research Laboratory, and a further nine similar trials were done by field officers of the Pasture Protection Section. Pellets were as successful as carrots for rabbit bait in all these trials, except in one case where the pellets were wet.

A series of trials have been planned to develop a "one-shot" pellet method of poisoning rabbits. Two trials in this series were completed during the year with promising results.

The "Tarbaby" method.—Several trials comparing poison mixtures and applicators were completed, and two large-scale field trials were commenced. It is hoped that the information gained from the latter work will enable firm recommendations to be made concerning the application and use of this technique in the field.

Control in the Western Division.—Measurements of the reopening of several types of warrens following ripping were completed on a study area at Menindee. A rabbit control programme for the whole property was drafted but continuation of this work has been postponed until more staff is appointed.

Population indices.—Several ways of measuring an index of rabbit populations have been compared during poisoning operation. One detailed trial compared indices in a forestry area where difficulty has been experienced in measuring the effects of poisoning operations on rabbit and other wild animal populations.

Feral Pigs

The biology of the feral pig is being studied so that efficient control techniques can be developed and assessed.

Ecology.—A survey of feral pig populations and habitats has been commenced in several areas throughout the State. Some specimens were collected at each area but the main biological collection is taking place at "Yantabulla", northwest of Bourke. In addition, a property in the Macquarie marshes has been chosen for a detailed study of population dynamics, movement, and behaviour.

Control.—Initial investigations into the use of traps for pig control are underway at several sites. Contact has been established with pig eradication groups in the Moree-Warialda area where feral pigs are causing damage to crops.

Foxes and Cats

Foxes and feral cats are being collected throughout the State for examination at Glenfield N.A.R.L. The aim of this survey is to define the importance of these two introduced carnivores as hosts of the tapeworm *Taenia ovis*. The types and numbers of all intestinal parasites will be related to the location of capture, age, food habits, and reproductive status of each specimen.

PLANT ECOLOGY

The Vegetation Survey of N.S.W. being conducted by ecologists of the National Herbarium, Royal Botanic Gardens, is proceeding with mapping at several different scales in a number of areas. The overall aim is to produce vegetation maps at 1:1,000,000 of the State; areas of special interest being mapped at larger scales. Most of the field work and mapping traverses have been completed for 100,000 sq m of the northwest of the State.

The vegetation of Lord Howe Island was surveyed and mapped at 1:15,840. The map, showing 40 vegetation units, is complete and is being prepared for publication in association with an explanatory memoir.

Two areas close to Sydney, namely the Hawkesbury River flood plain and the Wianamatta Shale, are being surveyed to assist investigations of other Departments. Historical research and interpretation are vital to these projects.

Striking small scale vegetation patterns in the Northern Budawang Range are being examined in co-operation with officers of the Rydalmere B.C.R.I.

SYSTEMATICS

Plant Systematics

Work in plant classification by botanists at the National Herbarium, Royal Botanic Gardens, has covered a wide range of groups.

Extensive studies on *Eucalyptus* have aimed at elucidating evolutionary trends and major groupings in the genus, associated with detailed work on the description of formerly unnamed species and the determination on the appropriate status of species and minor groups.

In *Acacia* a phytochemical survey of flavonoids in the bark and heartwood of Australian species continued and most species have now been sampled. A revision of the bipinnate wattles is nearing completion.

Comprehensive studies on the New South Wales species of *Cyperus* and *Eleocharis* (Cyperaceae) and *Plantago* (Plantaginaceae) for the Flora of New South Wales are almost complete. Other studies leading to publication in this Flora are in progress on the Tremandraceae, Caesalpiniaceae, Epacridaceae, Papilionaceae and certain groups of Pteridophytes.

Detailed investigations, aiming at revised classifications, are under way in *Casuarina* (several new species from Western Australia described), Orchidaceae (revision of *Arthrochilus* complex completed, studies of *Chiloglottis* in progress), *Grevillea* (revision proceeding on this large genus of Proteaceae), Piperaceae, Urticaceae, *Veronica* and allies (Scrophulariaceae), *Sporobolus* (Gramineae), *Galium* (Rubiaceae), *Zieria* (Rutaceae) and several groups of Compositae and Papilionaceae. The freshwater algal genus *Scenedesmus* has also been investigated.

A recent development has been a joint project, with the University of Sydney, on ultrastructure and anatomy in the Gramineae and allied families. Such studies on the Gramineae (grasses) are well advanced and work on the Cyperaceae (sedges) has begun. Another new undertaking is a biosystematic study of breeding systems in *Boronia* and allies (Rutaceae).

Chromosomal investigations have continued in *Oenothera* (Onagraceae) and *Plantago* with the survey of chromosome configurations and numbers in almost all species native or naturalized in New South Wales.

Work continues on a census of the plants of the State, begun in 1970. Compilation and checking of the Gymnosperm and Monocot lists is almost complete and substantial portions of the Dicotyledons are covered. Lists of plant species for Lord Howe Island and for the Mt Kosciusko area have been compiled from herbarium records and field studies.

The herbarium collections, a basic source material for research in systematic botany, continued to expand with a high rate of incorporation of new specimens.

Studies and evaluation have been made of the work of several botanists important for their collections or publications on the Australian Flora. Particular attention was given to Banks and Solander and also to the French botanist Gandoger.

Fungal Systematics

The Biology Branch Herbarium of the Rydalmere B.C.R.I. is the largest mycological collection in Australia, with over 35,000 specimens and growing at about 2,000 specimens per year. A programme of indexing and computer recall of herbarium information has been undertaken. The testing programme was completed and input of specimen information into the computer is proceeding. Data from these specimens and also from a comprehensive literature survey combined with thorough checking of the literature records is being used to prepare an annotated list of all fungi parasitic on plants in N.S.W. Special attention is given to diseases of trees and native species, particularly Poplar rust and a shoot blight due to *Ramularia*. The taxonomy and life cycle of *Claviceps phalaridis*, an ergot fungus attacking the important pasture grass *Phalaris*, is being investigated.

Insect and Nematode Systematics

The Weevils (Curculionidae) are the largest family of living organisms and include many pest groups. Their distribution and plant hosts are being surveyed, together with intensive investigation of some of the species, while 1242 new specimens were added to the weevil collection.

The collection of nematodes parasitic on plants was increased during the year by new collections of many groups and intensive studies were made of the genus *Xiphinema*, of which some species are vectors of plant virus diseases while others are damaging parasites.

NEW APPROACHES IN ENTOMOLOGY

(see also sections dealing with individual crops and livestock species)

Problems in the search for substitute chemicals to alleviate concern with resistances and residues have led to alternative means to combat insect pests being sought. For this reason, research was begun at the Entomology Branch of the Rydalmere B.C.R.I. into the hormonal control of basic processes in insects.

Regulation of Ovarian Growth in Hemiptera

Investigations using the bronze orange bug as an example indicate that egg production is completely regulated by internal factors. These mechanisms may be useful in controlling Hemiptera of economic importance.

Feeding Processes in Insects

Hormones regulating feeding processes in insects are known. These hormones are being examined in the American cockroach by a new process, involving a low angle of incident light rays.

PESTICIDE CHEMISTRY

Pesticide Uptake into Pasture and Grazing Animals

Recent surveys by the Lismore Board of Tick Control Laboratory have indicated a problem with dieldrin residues in dairy and beef animals on the North Coast. Residue hazards from soil applications of dieldrin and heptachlor recommended for legume pasture establishment are therefore being evaluated in a field experiment with Wollongbar A.R.S. This work, commenced in 1972, involves three years observations on dairy cattle and calves grazing areas treated according to Departmental specifications.

The physical and biological factors influencing the absorption and translocation of dieldrin in pasture species are also being investigated.

Pesticide Residues in Eggs and Poultry Meat

Experiments in progress at the Seven Hills Poultry Research Station, involve investigation of DDT residues in eggs and poultry meat from the use of contaminated rice hulls as deep litter. Additional work is concerned with the effect on egg production and residues of feeding Dexon treated wheat to poultry. Dexon is one of several fungicides under consideration as bunticides to replace hexachlorobenzene and mercurial compounds.

Environmental Residue Studies

Pesticide contamination of the Namoi cotton environment.—The incidence of DDT in non-target aquatic areas adjacent to sprayed cottonfields of the Namoi Valley is being investigated in co-operation with the National Parks and Wildlife Service and the State Fisheries Branch of the Chief Secretary's Department.

A survey in 1969–70 indicated some environmental contamination had occurred, particularly with associated wild life such as fish and birds. The area was resurveyed in 1971–72 following severe flooding of the Namoi River in 1971. Although analyses are incomplete, DDT levels in ducks appear to be higher than before the floods.

Dieldrin residues in wildlife.—Surveys were conducted with the National Parks and Wildlife Service to assess the hazards for bird wildlife in areas where pasture seed has been treated with dieldrin to prevent harvesting by ants. Dieldrin residues in five bird species in 1970 and 1971 in treated (Bathurst) and untreated (Mudgee) areas suggested that a greater hazard existed where treated seed was sown.

Pesticide Residues in Cottonseed Hulls and Wheat Dust

Surveys of Cottonseed hulls and wheat dust used as stock feed or in formulated feeds, indicated that while the hulls contained permitted levels of DDT, wheat dust sometimes contained excessive levels of maldison, gamma-BHC and DDT. Persons formulating feeds were instructed to dilute wheat dust with other ingredients to reduce residues to acceptable levels.

Benomyl Residues on Fruit

The effect of experimental and commercial treatments of benomyl on residues in canning peach, cherry and tomato fruit have been investigated, to assist the Department in recommending acceptable treatments. With the exception of fresh peaches, all preharvest spray and post-harvest dip treatments gave acceptable residues when related to Australian tolerances. Peach residues were acceptable after canning.

Cattle Dipping Investigations

(See also, Diseases of Cattle)

Investigations associated with the behaviour of cattle dips and the residues in animals resulting from dipping treatments have been conducted by the Lismore B.T.C.L.

Improvements in residue methodology have included a new method for determining chlorphen-amidine in animal tissues, based on the quenching of fluorescence on a thin layer chromatographic plate. A device for the batch spotting of plates was also developed. The thermionic detector used in gas chromatography, and the sweep codistillation apparatus used for clean up have also been improved.

WATER QUALITY

Improved Analytical Methods

New methods were developed at the Rydalmere B.C.R.I. for determining phosphate, sulphate and iron levels in water, kits for iron analysis having been designed for use by country officers.

Control of Toxic Algae

Assistance was provided by the Rydalmere B.C.R.I. to the National Herbarium in investigating control measures for toxic blue-green algal blooms at Braidwood. A relationship between available phosphate and the incidence of blooms was established, control being achieved by precipitation of insoluble aluminium phosphates.

SOIL SURVEY

Surveys of Departmental Research Stations

Surveys of parts of research establishments at Tamworth and Duck Creek and all of the C. B. Alexander College, Tocal, were completed.

Soil Potassium Survey

With the soil potassium survey of the Coast and Tablelands of N.S.W. the aim is to measure chemically the plant-available potassium levels in soils of that part of the State where potassium deficiency could be encountered so as to gauge the relative importance of soil potassium research work to this Department.

Field and laboratory work on the South Coast and Tablelands (stage I) is complete. A study of variation in soil potassium throughout the year at selected sites in that area is expected to be finished by September, 1972.

Results to date indicate only slight variation through the year at most of the test sites; some had greater variation but the magnitude will not affect the basic conclusion drawn from Stage I of this work.

Stage II, extension of the survey to the rest of the Coast and Tablelands, is in the planning stages.

PLANT NUTRITION

(See also sections dealing with individual crops)

Acid Soils

Slag.—Slag, a waste product of the steel industry which is causing a serious disposal problem, is being evaluated as a lime source for acid soils subject to aluminium and manganese toxicity. Glasshouse experiments and chemical analyses have been conducted at the Rydalmere B.C.R.I. with granulated and air-cooled slag on two types of acid soil. Both types of slag corrected aluminium and manganese toxicity in lucerne, even though the slags contained rather large amounts of these two elements. However, both slags were required in amounts two to three times that of agricultural lime to achieve similar results.

Lime.—Continued application of ammonium sulphate on kikuyu-based pasture on a red basaltic soil at Lismore, acidified the soil, released soluble aluminium, and reduced plant uptake of molybdenum, phosphorus, and calcium.

Lime (30 cwt/ac) countered the acidifying effects of ammonium sulphate, increased dry matter production and reduced soil aluminium to non-toxic levels.

Molybdenum deficiency.—Most of the certified hybrid maize seed produced in N.S.W. is grown on the coast on molybdenum-deficient acid soils, where heavy rates of nitrogenous fertilizer also tend to depress the molybdenum concentration of the seed. High rates of molybdenum fertilizer have been used to produce seed with an adequate molybdenum content. The practice is not only costly but may have a residual effect which could upset the copper metabolism of livestock subsequently grazing on these paddocks.

Manganese toxicity.—Field and glasshouse studies of slightly acid soils from Albury have shown marked seasonal variations in levels of available manganese. Levels toxic to pastures particularly during establishment, may occur either after waterlogging or heat exposure. Soils vary in reaction to these conditions.

SYMBIOTIC NITROGEN FIXATION

Production and Use of Legume Inoculants

With a view to improving the first stage of inoculant production a study was made at the Rydalmere B.C.R.I. of the effect of the type and concentration of yeast extract and carbohydrate on the growth of rhizobia in broth culture. Galactose was generally favoured by most strains.

Poor quality clover inoculants were found among cultures purchased in all States. These were caused by an accumulation of salt in the peat deposits at Mt Gambier, S.A., where the carrier material originates. Species of rhizobia differed in their tolerance; medic organisms grew at 1.3 per cent salt whereas clover strains were affected at levels above 0.38 per cent salt.

Strains of rhizobia used in commercial cultures for temperate legumes were compared with new isolates for effectiveness in fixing nitrogen in field trials at Tamworth in conjunction with the Tamworth A.R.S. All commercial strains performed well and no replacements were made.

Lime pelleting legume seed is a well-established practice for temperate legumes but its applicability to tropical legumes has been questioned. In storage experiments in the laboratory rhizobia survived equally well on the seeds of four tropical legumes whether applied in 15 per cent gum arabic solution or under a coating of lime or rock phosphate.

Naturalized Root-Nodule Bacteria in Soils of the North West Slopes

Naturalized medics and sown lucerne in this area are generally nodulated but the efficiency with which nitrogen is fixed is not known. Studies at the Tamworth A.R.S. have shown that naturalized rhizobia are frequently ineffective with medics and at some sites there are no clover or lupin rhizobia.

Nodulation of Tropical Legumes

Failure to nodulate *Dolichos* on the red soils of the North Coast have limited its usage. These failures can now be attributed to competition from naturalized rhizobia and high soil nitrogen in clean seed beds. Problems associated with competition have been highlighted because the current commercial strain, CB 756, is a poor competitor and varies within itself in effectiveness in fixing nitrogen. Another strain, CB 1024, has proved to be as effective as the best isolates of CB 756 and is also a good competitor with naturalized rhizobia. This strain will be included in inoculants for N.S.W. for the 1972-73 season.

The usefulness of *Glycine wightii* on red soils on the North Coast has been restricted by delays in nodulation which limits early growth. Studies at Wollongbar A.R.S. have shown that some improvement in nodulation is obtained by adding lime. Higher rates of lime will be used in trials sown in 1972-3.

Slowness to nodulate is also affecting the usefulness of *Trifolium semipilosum* in the Grafton district. Nodulation of this plant has been shown to be highly temperature dependent and did not occur at temperatures lower than 15° C. Nodulation was optimal at 25° C the temperature which favoured maximum nitrogen fixation.

SOIL MICROBIOLOGY

(See also sections dealing with individual crops)

The research programme at the Rydalmere B.C.R.I. is aimed at developing biological methods to control important soilborne diseases of crop plants. These diseases are responsible for many of the most important crop losses in N.S.W. and are extremely difficult to control by conventional methods such as fungicide treatments or use of resistant cultivars.

Control of Phytophthora Root Rot

Phytophthora spp. cause some of the most destructive fungal root rots of horticultural, floricultural and forest plants. Some soils are naturally suppressive to these pathogens and prevent them causing disease. An explanation of the suppressive characters is being sought and results so far indicate that soil microorganisms antagonistic to these pathogens are in part responsible. Attempts are being made to establish these microorganisms in soils where *Phytophthora* spp. are a problem. The effect of soil physical factors, especially aeration, on the ecology of *Phytophthora* spp. is also being studied.

Elimination of Fungal Resting Structures from Soil

Most soilborne plant pathogens survive unfavourable conditions by producing resting propagules. If survival of these propagules can be prevented diseases caused by these pathogens can be controlled. It has been found that biological control of many of these propagules can be promoted with controlled drying and wetting treatments or by the use of sublethal treatments with fumigants. These treatments alter the permeability properties of the propagules until nutrient leakage is stimulated above a certain threshold level. Death of the propagules results from the subsequent activity of other soil microorganisms and not from the loss of nutrients *per se*.

Form of Nitrogen and the Biological Control of Plant Pathogens

Research is in progress to examine the feasibility of using specific forms of soil nitrogen to promote biological control of wheat root pathogens. The effect of different forms of nitrogen on the persistence and virulence of the pathogen and on host susceptibility is being examined.

Treatment of Soil, Seeds, and Vegetative Plant Parts with Aerated Steam

Aerated steam is used widely in nurseries to partially sterilize soil. This treatment kills plant pathogens but leaves many beneficial, saprophytic organisms undamaged. Research into the more efficient use of aerated steam to treat soil and also to eradicate pathogens from seed and vegetative plant parts is in progress. Recommendations can now be made on the treatment required to eradicate a range of pathogens from seeds of ornamental and vegetable seeds.

ANALYTICAL METHODS

X-ray Fluorescence Spectrometer

The X-ray spectrograph located at the Rydalmere B.C.R.I. is fulfilling its function of handling large numbers of routine samples of plant material. There is a large amount of research development investigations to be fitted in with the routine operation of the instrument to extend its scope and efficiency. Sulphur and silicon are among the specific elements for which requests for analysis have been received.

Atomic Absorption Spectroscopy

Methods have been investigated for the determination of cobalt, mercury, and sulphur by atomic absorption spectroscopy. Cobalt, measured in soil extracts, gives a satisfactory level of sensitivity whilst mercury, in pesticide treated media, is vastly more sensitive than the colorimetric method used to date. Sulphur, in biological samples, is analysed indirectly as barium precipitated as barium sulphate. The level of sensitivity is quite satisfactory.

"Autoanalyser" Automated Colorimeter

A method for nitrogen which overcomes the interference and acidity problems associated with the colorimetric determination of this element, is being investigated with initial promising results.

ELECTRON MICROSCOPY

The electron microscope located at the Rydalmere B.C.R.I. has been used as a service instrument to check the presence of virus particles in biological and plant samples. It also has been utilized for investigating ultrathin sections of samples for disease.

On the research side it has been applied to various types of disease and fungicide investigations in terms of ultrastructure and plant virology. The effect of viruses on plant host ultrastructure has been determined on lettuce mosaic virus on hosts *Chenopodium quinoa* and lettuce.

CLOUD SEEDING

The research project investigating the effectiveness of cloud seeding, based at Cobar, is now in its third year. The project compares rainfall over the "target area" with two adjacent unseeded "control areas". Target area rainfall for the three experimental years is also compared with that of the previous 40 years.

Analysis of the first year's results (1969-70) indicates an increase equivalent to 181 points or 14 per cent. This is of course cannot be considered conclusive. Analysis of the 1970-1 results and changes in summer and winter rainfall for 1969-70 and 1970-1 are currently in progress, and when these and downwind effects are completed, it is hoped verification of the first year's results will be obtained.

BIOMETRICAL RESEARCH

Biometrical Branch research arises from the need to have a range of methods available for efficient design and analysis of surveys and experiments. The three major fields of research are methodology, computing, and experimental design investigations. All biometricians are involved in using new techniques which are either developed within the Department, or reported in the literature.

METHODOLOGICAL ADVANCES

Research on the Thomas Distribution was carried out as part of a Masters degree programme. Simulation of this discrete distribution was done for both random and contiguous sampling for various quadrat sizes. It is expected that this distribution will have applications to the study of counts of insects and weeds in research work.

Study of various types of similarity indices has led to the derivation of some empirically attractive clustering criteria. Applications have included the selection of "matching herds" for the Department's work on mastitis control, and a study of the chemical components of rock phosphate imported from various sources.

Further work has been done on analysis of variance methods. Non-additivity tests are optionally available for routine analysis of variance, and considerable experience has been gained in the interpretation of non-additivity analyses when various transformations of the data are being examined. The estimation of pasture availability by the combination of regression estimates from different assessors has been programmed to allow for different forms of regression of estimated pasture availability on measured availability of "standard" plots.

STATISTICAL COMPUTING

A series of seven algorithms has been developed for various matrix manipulations. These algorithms perform efficient permutations of rows and columns of symmetric matrices, inversion using prior knowledge of inverses of submatrices, and the generation of statistics associated with each member of a subset of all possible regression equations. These algorithms form the basic modules for a large proportion of computer programs used by the Biometrical Branch. Modifications and extensions to programs used routinely for analysis of experimental data have continued to occur.

DESIGN INVESTIGATION

Preliminary work has been done in the development of a new class of experimental designs for use by research workers comparing a large number of "new" treatments (e.g. varieties) with a small number of "standard" treatments. Properties of these designs, to be called "augmented lattices", are being investigated.

AGRICULTURAL ENGINEERING

At the recently established Agricultural Engineering Centre, Glenfield, a research and development programme is being carried out for the agricultural industries.

AGRICULTURAL MACHINERY

Tomato Harvesting

Because of the importance of mechanization in the vegetable industry, a tomato harvester is under development for local manufacture. The prototype machine was field tested and is currently being redesigned as a commercial prototype. A vine trainer for shaping the tomato bushes for mechanical harvesting has also been manufactured and will be used in field trials.

Fruit Picking

A fruitpicking platform to position six operators for picking fresh fruit has been designed.

Hay Handling

Equipment is being developed so that half bales of hay can be carted and stacked in a shed by a single operator.

Minimum Tillage

A comparison of minimum tillage techniques and conventional cultivation is being undertaken at Glenfield V.R.S. and Narrabri A.R.S. to establish the potential of recently developed commercial equipment.

FOOD STORAGE

Controlled Atmosphere Storage

Development of the Open Flame Controlled Atmosphere Generator has been completed. The unit is in commercial production and is being extensively used in cool stores throughout Australia.

Ethylene Scrubber

A controlled environment room for research on the storage of bananas has been built at Glenfield. It is being used for testing a prototype ethylene scrubber for use in fruit storage.

Grain Drying

Grain drying research to establish the maximum safe operating temperature for grain sorghum for feed purposes has been carried out. Observations have been made on aeration of grain in a commercial silo in the Gloucester district to ascertain the value of this technique for storage under semicoastal conditions.

EQUIPMENT FOR AGRICULTURAL RESEARCH

A second pasture drill for use by Research Agronomists has been manufactured commercially to a Glenfield A.E.C. design.

An experimental tobacco curing kiln has been manufactured for use at the Glen Innes A.R.S.

Work is proceeding on the development of two weighed lysimeters for cereal research at the Wagga A.R.I.

A bank of isolation cabinets for avian disease research has been constructed for the Glenfield V.R.S.

SOCIAL RESEARCH

ECONOMICS AND MARKETING

Agricultural Adjustment

North Coast dairying area.—A study has been in progress since 1967 from Wollongbar A.R.S. to determine the impediments to adjustments which could correct the so called "low-income problem" in dairying on the Far North Coast. A survey of dairy farms was made to try to delineate desirable adjustments. However, analysis revealed that none of the adjustments suggested would make existing farmers significantly better off. Analysis was then concentrated on an attempt to specify accurately the nature of the low-income problem.

It was concluded that the structure of dairy farming on the North Coast will have to change if new resources are to be efficiently employed and farm families are to enjoy a satisfactory level of welfare. In the short run, however, there is no good case to show that the returns to existing resources could be substantially improved or that dairy farming families represent a welfare problem. The decline in dairying suggests that resource use is adjusting rapidly without unacceptable hardship.

In a related study from Wollongbar A.R.S., surveys are being made of existing beef producers to measure levels of income and associated circumstances of production such as capital investment, herd size, and property size. The surveys together with technical research results, will also provide data for a linear programming study designed to examine different management, feeding and cropping practices of the different forms of beef production. Analysis of the data has shown that the size of holdings and of beef herds changing from dairying to beef are below the size required for units to be viable and provide full-time employment for the operator. Preliminary results suggest that returns from "growing out" store animals from weaner age can be greater than returns from vealer production in high rainfall coastal areas.

A study of the economics of private forestry on the North Coast was prompted by the conclusion of other research workers that private forestry was potentially a profitable sideline to dairy production or monoculture. Preliminary investigations ruled out all species except *Populus deltoides* var. *angulata* as potentially profitable. In collaboration with the Forestry Commission, test plantings have been made on ten sites in the Richmond area.

Southern wheat belt.—The potential for enterprise adjustment on farms in the southern wheat belt is being explored through a linear programming analysis of a representative farm situation. This will be used to assess optimal enterprise organization, and to test the sensitivity of enterprise combinations to changes in price, capital availability, and labour supply. At a latter stage the farm plans suggested by the initial linear programming will be augmented by pasture and crop growth models and simulation studies carried out using rainfall frequencies.

Irrigation areas.—In 1970, following a survey of farmers in the Coleambally Irrigation Area, an interdepartmental committee was set up to investigate and report upon the suitability of Coleambally horticultural farms. The services of a departmental economist have been extensively involved in the background research for the committee's reports.

Enterprise Budgeting

A large number of publications relating to the profitability of new and existing enterprises have been prepared for regionally distributed bulletins. The large demand by farmers for this type of information has led to research interest in the value of this information and the best way of presenting it.

Meat Marketing

A major research effort was concerned with the Department's submission to the Parliamentary Select Committee enquiring into the Meat Industry. Emphasis was given to marketing margins and alternative marketing channels.

Commodity Investigations

During the year investigations of market prospects for cereals, oilseeds, grain legumes, and other miscellaneous crops were carried out. The Division is also undertaking medium-term projections of a number of commodities for the information of the Guidelines Committee assisting the Rural Assistance Board. The report on the prospects for beef and veal has been completed.

EXTENSION

Pasture Problems on the North-West Slopes

Hypotheses about the rate of property and pasture development in the Ashford Shire are being tested through a mail questionnaire. The Shire is representative of a larger area of the North-West Slopes of the State and the results of the study are expected to help in the formulation of extension and research programmes for that area.

Structure of Farms in the Lower Hunter

Analysis continued of data collected in a survey of a 10 per cent sample of farm businesses in the local government areas of Dungog, Port Stevens and Maitland. The survey included physical, financial and social aspects of 119 farm businesses. The objectives are: to analyse the socio-economic structure of the farm businesses and their adjustments of recent years; to examine the relative importance of different socio-economic forces on adjustment; and to suggest problems of, and opportunities for, future development of farming.

Education of Farmers in Farm Business Management

Methods of extension in farm business management are being evaluated in the Mid-Western Region to develop methods that lead to greater acceptance and adoption by farmers of improved practices in farm business management. In 1971-72 the method tested was discussion with two small groups of farmers on one night per week for eight and nine weeks. Topics for discussion were decided by the farmers as the course progressed and farmers did some preparation for the meetings. In future experiments district extension officers as well as the regional economist will have tutorial roles.

Evaluation of the Farm Records Analysis Project

The farm records analysis project being conducted by officers of the Department in conjunction with the Agricultural Business Research Institute of the University of New England is being evaluated. The 140 farmers involved and the 16 officers of the Department who have been co-ordinators were asked to complete a mail questionnaire. The analysis will be completed early in 1972-73 and will provide information needed for decisions about the future of the project.

Communication and Distribution of Work Time in Agricultural Extension

Differences in the ways district extension officers, regional supervisors and head office specialists perceive some aspects of the extension service are being examined. Major differences would impede communication between these three groups of officers. Another section of the project concerns the distribution of work time of district officers. Half the experienced district officers began recording the distribution of their time between fourteen types of work in spring 1971. The recording will continue for a year. Differences in distribution will be tested against situational, personal and professional variables.

Information and Changes in Farm Practices

A 10 per cent sample of farmers in each of three shires was interviewed with the objectives of identifying the differences between those people who make substantial use of the services of the Department and those who do not and of relating the channels of information used by farmers to current changes in practices on their farms. In addition, the project is testing a new method of studying changes on farms and is producing information about changes taking place that will be of value to extension workers in the area. Farmers in a fourth shire have yet to be interviewed.

4. EXTENSION

EXTENSION STAFF

The Public Service Board approved an up-grading in the status of regional supervisors from assistant principal A to principal B. The regrading became effective in May, 1972. The Board advised that it would review the status of regional supervisor positions in May, 1973.

The transfer, retirement or resignation of twelve district fruit officers in the last 5 years reduced the efficiency of the Division of Horticulture's extension services. Staff changes in districts and difficulty in filling vacancies with adequately trained officers came at a most inopportune time, because of the economic difficulties experienced by growers in most horticultural industries.

TRAINING OF EXTENSION OFFICERS

TRAINING SYSTEMS

In-service development of officers in training continued in all regions. The present system gives a young officer a minimum of six months' intensive training in one or more regions. Under the guidance of the regional supervisor, officers are placed with experienced personnel of other subject matter divisions as well as those of his own division. They are given instruction and actual experience in all aspects of extension work and of country office administration procedures. Training assignments include data collection, report writing, writing for publication, radio talks, lecturing, and group discussion procedures.

A committee was established to examine present training methods and procedures, and to make recommendations as to how these could be improved. The committee held three meetings. Several subcommittees were formed to review specific training areas, and report early in 1972-73.

Livestock officers, beef cattle, and livestock officers, poultry, undertook in-service training in private industry.

In-service training within the Division of Dairying was reviewed and progress made in developing future training policy.

Economists provided training and guidance to extension officers at the regional level, in management techniques and in the interpretation of economic data.

SCHOOLS AND COURSES

Extension Methods

The annual in-service training extension service/methods school was conducted. The school was residential and of 10 days' duration. It was attended by forty-two officers, including three rural youth supervisors from the Department of Education, two officers from commercial agricultural companies, and one from the Australian Broadcasting Commission. Most sessions were conducted as small group discussions and tutorials. This approach allowed greater scope for student participation and consequently more meaningful examination of the topics discussed.

Regional workshops designed to improve officers skills in extension methods were held in the Mid-Coast and Hunter, North Coast, Southern, South Western and Western Regions. Subjects were: writing for extension; working with rural groups, including group discussion techniques; and the use of photography in extension.

Six officers attended a 2-week course in agricultural extension at the University of Queensland.

Farm Management

Thirty-two officers attended a residential farm business management school.

Irrigation

A weeklong advanced irrigation school was attended by sixty-seven agronomists and fruit officers.

Three agronomists in training completed the 1971 irrigation certificate course at Yanco Agricultural College and Research Station, and another three enrolled for the 1972 course.

Chemistry

A 2-day chemistry symposium with an extension/research liaison theme was held for agronomists and fruit officers.

Other Schools

Livestock officers, sheep and wool: Sheep handling courses were provided for younger officers. Six officers attended a 5-day school organized by the Australian Wool Commission to demonstrate wool classification by objective measurement. Four officers took part in a Commonwealth sheep and wool refresher course.

Livestock officers, beef cattle: Six officers attended a workshop on the national beef cattle performance recording scheme, organized by the Agricultural Business Research Institute of the University of New England.

Veterinary officers and veterinary inspectors: Thirty-four officers attended a course in virology and virus diseases arranged by the Post-Graduate Committee in Veterinary Science of the University of Sydney, and eleven officers undertook a refresher course in general disease matters conducted by the same committee.

Two schools were conducted to train veterinary officers and veterinary inspectors in the diagnosis and eradication of exotic diseases, with particular reference to foot and mouth disease. Each school was attended by twenty-four officers. The schools embodied practical exercises in which a simulated outbreak of foot and mouth disease was dealt with at emergency headquarters, farms, saleyards, abattoirs and milk factories. Representatives of the armed services, civilian defence organizations, shires and other bodies were also involved.

A school was held at the Artificial Stock Breeding Centre, Berry, to train officers in the technique of bull semen appraisal.

All dairy officers attended a 5-day school devoted to cultured milk products, the Milko tester, and discussion group procedures.

Agricultural machinery officers attended a workshop on the mechanization of alternative crops to wheat.

STUDY TOURS AND CONFERENCES

National Workshop

Four officers attended a National Workshop on In-Service Training and Development of Extension Workers, in Brisbane. It was organized and conducted by the Queensland Department of Primary Industries for the Standing Committee on Agriculture. Generally, the objects of the workshop were:

- (i) to enable those involved in and with training to meet, study exchange and develop ideas on the training and development of extension staff;
- (ii) to study the implications of the need for the total development of extension workers as an integral part of the development of extension services;
- (iii) to form a continuing association between the States on the training and development of agricultural extension workers.

Dairy Farm Management

The Division of Dairying undertook and completed the major responsibility in organizing a 2-week Commonwealth Dairy Farm Management Conference, to be held in Sydney in July, 1972, for the Standing Committee on Agriculture. Objectives of the conference were:

- (i) to review and update knowledge in dairy farm management;
- (ii) produce a handbook for extension and research workers throughout the Commonwealth.

Study Tours

An agronomist in training undertook a tour of irrigation districts of Australia on a Royal Agricultural Society travel scholarship.

The district agronomist, Glen Innes, was awarded an ANZAC fellowship to cover a year's study and travel in New Zealand.

POST-GRADUATE STUDY

Eight officers successfully completed the 1971 course for the Hawkesbury Diploma in Rural Extension and nine officers enrolled in the 1972 course.

One officer completed formal work for a masters degree in science with an extension topic for his thesis. Twenty-five extension officers were engaged in external studies through Macquarie University or the University of New England. Some other officers were engaged in post-graduate studies partly related to extension.

NEW DEVELOPMENTS

Rural Adjustment

In June, 1971, a meeting of senior officers of the Departments of Agriculture, Lands, Conservation, and Decentralisation and Development with the Deputy Director-General, Department of Agriculture, as Chairman, decided to proceed with a proposal to conduct an inter-departmental workshop on problems of rural adjustment.

The objective of the workshop was to examine in detail and report on the scope and problems of governmental operations in rural areas as they bear on adjustment problems associated with farms, farm families, and the rural/urban sector as a whole.

It was also agreed that an integrated report of workshop discussions would be presented to the Minister for Agriculture, who would then refer it to his Ministerial colleagues.

The workshop, in November, 1971, was attended by representatives of the following Departments and authorities: Agriculture; Conservation, including the Forestry Commission, Soil Conservation Service and the Water Conservation and Irrigation Commission; Decentralisation and Development; Education, including the Rural Youth Organization; Environmental Control; Lands; Local Government; National Parks and Wildlife Service; Public Works; Rural Reconstruction Board; Social Welfare; Technical Education; Tourism; and Western Lands Commission.

Most of the Departments and authorities contributed papers setting out their activities in rural areas and listing resources, methods of operation, problems and deficiencies. Additionally, some background papers were prepared containing factual material for general reference, together with five resource papers on various aspects of rural adjustment.

It was decided to recommend to the Minister that the Department of Agriculture convene an interdepartmental standing committee on rural adjustment to co-ordinate counselling, advisory and educational services in respect to rural adjustment, to plan the production of advisory publications, to plan training programmes for officers, review the need for social and economic statistics relating to rural adjustment, and, if necessary, to submit plans for their collection.

A Standing Committee on Rural Adjustment was established in May, 1972. Departments represented are Agriculture, Conservation, Decentralisation and Development, Education, and Technical Education, with the Deputy Director-General, Department of Agriculture, as Chairman.

Standing Committee resolved that the Department of Agriculture be asked to arrange for its regional supervisors to convene Regional Inter-Departmental Rural Adjustment Committees, committee objectives being to:

- (i) Assess adjustment needs of the rural community and the availability of resources for rural adjustment work.
- (ii) Co-ordinate and integrate existing adjustment activities of the various government instrumentalities.
- (iii) Initiate educational programmes and other services aimed at providing rural communities with greater knowledge and understanding of adjustment processes and improving their ability to make sound decisions affecting their future activities.
- (iv) Determine and provide training and support required by officers involved in rural adjustment work.
- (v) Act as a communications channel to and from the Standing Committee.

It was agreed that representation on the regional committees would be as follows;

Agriculture—two representatives (the regional supervisor plus one additional officer); and one each from the following: Education, Technical Education, Conservation, Decentralisation, Labour and Industry—Vocational Guidance Service, and the Rural Bank.

Standing Committee decided that the regional committees would operate as follows:

- (i) The regional supervisor of agriculture to be convenor and chairman, and provide secretarial assistance.
- (ii) The regional committee would be a local co-ordinating committee and co-opt working committees as required. Working committees would comprise specialists from any source within or outside the Service.
- (iii) The regional committees would be given specific tasks from time to time but would, within the specified objectives, be largely autonomous.

The initial tasks of each regional committee would be to:

- (i) undertake a preliminary assessment of:
 - (a) the adjustment needs of the rural community in the region; and
 - (b) the availability of resources for rural adjustment work.
- (ii) define existing programmes.
- (iii) advise other proposed action programmes.
- (iv) state bases on which conclusions in (i), (ii) and (iii) are drawn.
- (v) report findings and proposed action programmes to Standing Committee.

Changing Extension Emphasis

Although there was a slight upturn in prices received for some farm commodities, there remained an underlying uncertainty in the minds of most farmers as to the future. Farmer attitudes had an effect on the type of advice sought from extension officers. Increased interest lay in broadly based enquiries related to marketing, commodity prospects and alternative enterprises.

The output of adjustment information relating to alternative on-farm activities, alternative structuring of present activities and to a lesser extent alternative off-farm activities was intensified.

Greater emphasis was given to the provision of information to persons servicing farmers, such as bank managers, accountants, stock and station agents, machinery firms and agricultural contractors.

Increased emphasis was placed on the development of positive team work between regional economists and extension officers in approaching regional extension problems.

Regional Specialists

Advantages arising from the appointment of sheep and wool specialists in the previous year became apparent through assistance given to district officers, and broader liaison with industry leaders than previously possible.

A special fruit officer was appointed to a new position at Leeton, to improve horticultural extension and regulatory services in irrigation areas.

Dairying

With the establishment of the Dairy Industry Authority, dairy officers were relieved of some regulatory duties and were able to devote more time to extension.

Farm Management Study

Two officers of this Department and an officer of the Queensland Department of Primary Industries were requested by Standing Committee on Agriculture to report on extension in farm business management. All States were visited and a report and recommendations prepared. Guidelines were proposed for future development.

Group Extension

The demand for more information of an economic nature, particularly in relation to selection of alternative enterprises, and to the rapid development of the beef cattle and pig industries, influenced extension officers to work more extensively with groups, both formal and informal. Development of discussion groups in some areas enabled officers to provide a more effective service to greater numbers of producers.

ACTIVITIES OF EXTENSION OFFICERS

Sheep and Wool

The economic situation of the sheep industry required a change in extension emphasis. Technical recommendations had to be highly oriented to economic aspects and the whole farm, whilst ad hoc advice assumed less importance and diminished in extent.

Extension officers made 2,002 farm visits, addressed 109 meetings, and conducted 50 demonstrations. They took part in 72 field days, made 238 broadcasts, 15 telecasts, issued 207 press items, and conducted 19 competitions.

Beef Cattle

The unprecedented expansion of the beef industry required an alteration in extension emphasis from production problems towards broader educational extension concepts, embracing co-operative efforts to define and resolve social and economic as well as agronomic and husbandry problems. Extension officers devoted greater attention to marketing, and emphasized the need for producers to make this an initial rather than an end consideration in planning.

Extension officers made 1,689 farm visits, addressed 132 meetings and undertook 71 trials and demonstrations. They took part in 150 field days and 67 schools, made 295 broadcasts, 10 telecasts, and issued 159 press items. Seven officers contributed regularly to direct mail regional newsletters.

Pigs

In a situation in which a production increase of seven per cent was accompanied by falling prices, extension officers emphasised a need for increased efficiency through improved management. There was a significant development of group extension activities.

They made 1,579 farm visits, undertook 168 lectures and demonstrations, addressed 50 schools, and conducted 16 C.E.S.G. demonstrations. There were 27 field days. Officers made 170 broadcasts, 5 telecasts, and issued 102 press items. Additionally they judged 8 competitions and classes at 27 shows. They also attended 7 seminars.

Poultry

Decreased farm numbers and an increased average flock size changed extension emphasis from farm visits towards field trials, group activities and farm management recording. There was a strong demand for information on housing and other aspects of duck management.

Extension officers made 939 farm visits, attended 169 industry meetings, gave 50 lectures/demonstrations and took part in 3 field days. They made 85 broadcasts, 1 telecast, and issued 82 press items.

Apiculture

The growing of extensive acreages of oilseed crops presented a hazard because of the increased use of pesticides highly toxic to bees. Extension officers endeavoured to foster close co-operation between all concerned to minimize bee losses whilst growers obtained satisfactory pest control. Increased costs called for extension effort to encourage improved efficiency of production of honey.

Extension officers in addition to personal visits to producers made extensive use of group activities and mass media.

Animal Health

Veterinary officers addressed 102 meetings, took part in 32 field days, and conducted 13 farmer school sessions. They made 102 broadcasts, 4 telecasts, issued 360 press items, and contributed 95 items to newsletters.

Dairying

Mastitis control continued to be the major extension activity. Knowledge gained from mastitis control programme demonstration farms proved invaluable in educating farmers to combat yellow stain, a major milk quality problem causing economic loss to producers, particularly in the northern area.

Extension officers made 10,960 farm visits, held 41 field days, attended 356 meetings and gave 520 talks to farmer groups, and on radio or television. They conducted 122 trials and demonstrations, attended 214 schools, conferences and courses, and undertook judging on 88 occasions. In addition they issued 279 press items and journal articles, and conducted 133 tutorial classes for factory operatives.

Horticulture

Requests for advice on herbicide use significantly increased, particularly for citrus, but also for pome and stone fruits. To a lesser extent there was increased interest by growers in trickle irrigation. Pome fruit growers sought more advice on tree training and pruning techniques for young trees, and there was a greater demand by them for advice on the operation of controlled atmosphere storage for fruit.

Extension officers made 6,053 farm visits, addressed 289 meetings, and conducted 97 demonstrations. They took part in 94 field days, contributed to 254 radio and television programmes, issued 301 press items, and prepared 10 journal articles for publication.

Agronomy

The economic situation of the sheep industry, wheat quotas, irrigation development, and expanded markets for beef, grains other than wheat and for oilseeds all contributed to a changed emphasis in extension. Less time was spent in advisory work on wheat and pasture improvement, whilst a greater proportion of time was devoted to coarse grains and oilseeds, and to irrigation development and production. A trend to greater emphasis on farm business management extension continued.

Extension officers averaged 90 days on office work, 18 days with field days and conferences, 70 days on field advisory work, and 17 days on trials and demonstrations. They conducted an average of 5 field days each. Officers addressed 332 meetings, made 1,054 broadcasts, 24 telecasts, and issued 691 press items.

Entomology

Entomologists assisted extension officers in making 108 farm visits and addressing 48 field days and meetings. They also supplied information on insect pest control for crop bulletins and spraying guides. Additionally they made 11 broadcasts, 2 telecasts, and issued 5 press items.

Economics

Regional economists assisted extension officers in their use of farm business management techniques, and in the interpretation of economic data.

Economists delivered over 230 addresses at meetings and field days, made 51 broadcasts, 8 telecasts, and issued 27 press items. More than 150 publications produced comprised regional leaflets, 22 departmental bulletins, and 10 journal articles.

Mechanization

Aspects of particular significance to extension officers related to the growing and harvesting of alternative crops to wheat, to the storage and handling of feeds for cattle and pigs, and to seeding equipment. They maintained close liaison with farm machinery dealers.

Machinery officers made 1,245 farm visits, addressed 55 meetings and conducted 20 schools. They took part in 75 demonstrations and field days, and arranged 12 farm tours. In addition they made 116 broadcasts, 7 telecasts, and issued 55 press items. They produced 40 regional leaflets, 1 departmental leaflet, and 13 journal articles.

EXTENSION PROGRAMMES

Division of Extension Services

Typical objectives included: training of extension officers; improvement of extension planning; development of group extension; evaluation of extension; liaison with research and agribusiness; provision of audio visual aids; improvement of publications.

Project extension.—An interesting development of programme planning commenced in the Northern Region, through a format for extension problem solving. The format is based on the campaign planning technique used by advertising agencies and is designed to co-ordinate all appropriate resources in a concerted effort to make an impact on primary producers. Its basis is the brief, which emphasizes strengths, weaknesses, and opportunities, and sets out a clearly defined target audience, target aim, and a suggested plan of action.

Pilot projects are dealing with potato quality on the Northern Tablelands, and beef cattle fertility in the eastern fall of the Northern Tablelands. Encouraging progress was made in both projects. Farmers were involved in the scheme from its inception, and gave ready support.

Changed emphasis.—Extension officers became increasingly aware of the need to recognize farm business management as an important consideration in deciding objectives and work plans.

There was a growing use of informal groups in extension.

Division of Animal Industry

Sheep and wool section.—Typical objectives included: promotion of grazing lucerne; promotion of objective measurement; evaluation of sheep rugs; encouragement of mini care strains of sheep; wider use of mulesing; assessment of age of effective first mating; assessment of the potential of chemical shearing.

Changed emphasis related particularly to the greater importance of economic aspects of objectives.

Beef cattle section.—Typical objectives included: assessment of seasonal variations in nutritive value of pastures; assessment of the place of lot feeding as a continuous and as an opportunity enterprise; greater use of performance recording; improved handling facilities; improved management techniques.

Change was evident in the extent to which assessments were made of local management and economic factors, and in the development of team work, particularly with economists.

Pig section.—Typical objectives included: improved housing and equipment; improved nutrition; establishment of on-farm performance testing; development of group extension.

Weight was given to efficiency improvement to counter falling prices. There was a significant development of group extension activities.

Poultry section.—Typical objectives included trials on: restricted feeding of replacement pullets; poultry house environment studies; egg bulk handling; improved brooding techniques. Other typical objectives were: improved stock management; increased use of mechanization.

Trials became a major component of programmes, and these proved to be valuable aids in extension.

Apiculture section.—Typical objectives included: improved yields; improvement of honey quality; greater efficiency of production; improved co-operation to reduce loss of bees from insecticides; training of producers in disease recognition.

Changed emphasis was noted in the extent to which officers liaised with agronomists, entomologists, farmers, and representatives of chemical firms, to improve crop pollination and to minimize bee losses.

Veterinary section.—Typical objectives included: increased awareness of the objectives and advantages of the brucellosis control programme; collection of data and education of producers in mastitis control in a joint project with the Division of Dairying; improved vaccine storage and use by owners; increased beef herd fertility through pregnancy diagnosis; increased knowledge of the importance of worm parasites; increased knowledge of wild pigs to develop methods of control; increased liaison with private veterinarians and industry specialists to promote control of poultry diseases.

Divisions of Dairying

Typical objectives included: quality improvement of milk and milk products; demonstration of mastitis control principles; formation of farmer discussion groups; improved milking machine efficiency; adoption of electric branding of cattle.

A reduction in regulatory commitments enabled more time to be spent on animal husbandry and farm management.

Division of Horticulture

Typical objectives included: control of banana weevil borer; promotion of avocado production; improved efficiency of dried vine fruit production; increased acceptance of herbicide management recommendations; improved market presentation of fruit; guidance in the establishment of wine grape plantings in the Hunter Valley.

Programmes were adversely affected by transfers in a number of districts, and the fact that most districts were staffed by newly appointed officers. These officers necessarily spent much of the year in becoming oriented to district situations.

Division of Plant Industry

Typical objectives included: increased areas of improved pastures in coastal districts; increased quantity and quality of stored fodder, including high moisture grain; improved efficiency of production of coarse grains under irrigation; increased volume and efficiency of production of oilseed crops with associated data collection and assessment; improved efficiency of cereal grain production; increased lucerne acreage; improved economic use of fertilizer in pasture/cereal rotations in winter pasture areas.

Programmes showed a consolidation in format, objectives and continuity, with development of main themes, and emphasis on the economics of production.

Division of Marketing and Economics

Objectives related mainly to improving the dissemination of information to producers and their advisers on the nature of adjustment problems, and on alternative solutions.

There was reduced emphasis on farm record analysis groups and on surveys. Work with small groups increased, as did co-operative work with extension officers.

Division of Research Services

Typical objectives included: collation and publication of information on stock feeding equipment and systems; publication of mechanization information relating to oilseeds and coarse grains crop production; running of tractor and engine maintenance schools; improved grain drying and cleaning; encouragement of improved workshop facilities on farms.

Much emphasis was given to the researching of available information on the mechanization of production of alternative crops to wheat, to meet growers needs in a situation where many had no previous experience with these crops.

Royal Botanic Gardens and National Herbarium

Projects included an exhibit directed to site planning and landscaping for home owners, and another which emphasised the value of tropical plants.

Requests for specimen identification continued at a high rate.

EXTENSION THROUGH MASS MEDIA

Publications

Agricultural Gazette of N.S.W.—(2-monthly; quarto; 64 pages)—Six issues were published, all being distributed in the nominal month of issue. Average lateness of distribution was 19 days, this being a big improvement on the previous year when only one of the nine issues in the 12 months was received for distribution in the nominal month of issue.

A total of 60 research papers appeared in the 6 issues. On average, these filled 6 pages of each issue of the *Gazette*. Circulation of the *Gazette* rose from 29,200 in 1970–1 to 30,000 copies in 1971–2.

Dairy Topics.—(Quarterly; octavo; 48 pages including covers)—Four issues were published, the first in July, 1971 and the last in April, 1972. The fifth issue, a special issue for which the Dairy Industry Authority provided all material and will pay printing and postage costs, was prepared for printing and submitted to the Printer, but was not distributed at the end of June, 1972.

Copies of *Dairy Topics* were forwarded to all registered dairymen in New South Wales. Total circulation was about 9,000 copies.

Poultry Notes.—(Quarterly; quarto; average 20 pages)—Four issues were published, the first in July, 1971 and the last in April, 1972. Circulation was 3,650.

Veterinary Notes.—(Quarterly; quarto; average 32 pages plus covers)—Four issues were published, the first in September, 1971 and the last in June, 1972. Circulation was 3,650.

Advisory Bulletins.—The list of advisory bulletins processed in the Editorial Section numbered 1,355, compared with 1,390 in 1970–1. Of these, 138 were in various stages of revision before submission to the Printer.

Printing of 110 bulletins was requisitioned during the year and 146 completed bulletins were delivered by the Printer. At 30th June, 90 bulletins were still with the Printer.

The number of bulletins distributed was 557,272. Of this total, 428,161 were sent to regional offices, 86,421 supplied in response to public enquiries in Sydney and 42,690 new, revised and reprinted titles supplied on circulation lists.

Science Bulletins.—Two science bulletins were edited by the editorial staff and requisitioned on the Printer. One was delivered by him.

Annual Report of the Department to Parliament.—The annual report of the Department of Agriculture for 1970–1 was produced for tabling in Parliament on 2nd December, 1971. Parliament on that date ordered it for printing. Proofs were checked in April, 1972, but at 30th June, 1972, the printed report had not been received.

Miscellaneous.—A book entitled *A Directory of Agricultural Research and Extension Personnel* (160 pages), was produced by the Extension Research Liaison Officer, Armidale. The book refers to all agricultural extension and research workers located in the Northern and North Western Regions.

Other printing jobs, including school handbooks, covers for annual reports, brochures, etc., requisitioned on the Printer, totalled fifty-one. Similar jobs received from the Printer totalled twenty-one.

Sales publications.—A second edition of *Pastures* became available in April, 1972, and a second impression of the first edition of *Butchering on Farm and Station* became available in June, 1972.

Regional publications.—There was a considerable increase in the number of regional publications produced during the year. Much of the increase was in newsletters. Some of these were concerned with specific industries (beef cattle, pigs, poultry, fruit, dairying) and others covered many aspects of primary production. Most of the newsletters were direct mailed to farmers who had requested them.

Radio

About 10,000 broadcasts were made from 2,866 radio tapes recorded. These figures serve to illustrate that extension officers generally are sustaining their use of this medium. The extension officer (radio) recorded 116 interviews with head office specialists for regional release. A considerable number of tapes were recorded for broadcast over the Macquarie Network relating to the "Wheat Farmer of the Year" Competition.

Special interviews with head office specialists and Sydney-based officials of such organizations as universities, United Farmers and Woolgrowers Association, and the Australian Wool Board, were recorded for campaign publicity programmes broadcast over radio stations in the Northern Region.

Twenty-two tapes were recorded for release to radio stations through regional channels by the senior extension officer (women's service). In addition, she recorded six subject matter series each of nine tapes, for use in national and regional programmes.

Departmental access to radio listeners was in some cases reduced or eliminated by commercial station policy changes. This happened when programming and advertising were more directly oriented to urban listeners.

Television

Ninety-one programmes were telecast. These were confined largely to four regions where station managements continued to support agricultural television programmes. In other regions agricultural information was used as inserts in news programmes.

The manager of television station NEN 9 Tamworth, following a rating survey, advised:

"We were most pleased with the survey results of "Landmark", which showed a distinct increase in the audience aimed at, as compared to the programmes scheduled on either side. Overall, Thursday night was second highest to Sunday in our ratings, and naturally this is the result of the total programming on that night. "Landmark" and "Division 4" shared the highest rating on Thursday night, but the "Landmark" audience was even higher than "Division 4".

The "Landmark" series of thirty-two telecasts each year is contributed by officers in the Northern, North Western, and Mid-Coast and Hunter Regions.

Press

Original press items (to newspapers, radio, and television stations) released through regional channels totalled 1,809. Another 114 news items were released from head office, including 29 items prepared by the senior extension officer (women's service).

The following changes occurred in extension officers' use of country press:

- A weekly column "Over the Farm Fence" was commenced by the district agronomist, Parkes in July, 1971. Another weekly column "Down to Earth" produced from Cowra was first published in May, 1972. These columns ensured that regular space was available for extension material each week in seven of the eleven newspapers published in the Mid-Western Region. Their commencement did not preclude the printing of normal type publicity items.
- In June, 1972, a 1,000 word weekly column was commenced in the *Northern Daily Leader* Tamworth. Officers throughout the Northern Region contribute copy through the publicity officer.
- A new weekly supplement "North Western Magazine" is printed offset at Moree, and appears simultaneously in all regional newspapers, as well as those at Tamworth and Barraba. Circulation reached 30,000 copies. The demand for agricultural material is high. Officers contribute special items, and photographs are used to advantage. Departmental content in this feature is limited only by the amount of copy which can be supplied.

GROUP EXTENSION

The Agricultural Bureau of N.S.W.

Branches of the Agricultural Bureau affiliated financially with the Executive Council in 1971-72, totalled 120, one less than at the 30th June, 1971. No new branches were formed during the year. Branches ceased to function at Lake Cargelligo, Kiacatoo, and Wellington.

At the 30th June, 1972, the Bureau had 6,732 affiliated members, compared with 6,943 at the 30th June, 1971.

State executive council.—All bureau regions were represented on the executive council. Four meetings were held with an average attendance of 71 per cent.

The Council spent a considerable amount of time on the problems facing rural industries and in developing long- and short-term objectives for the future of the Agricultural Bureau. Council adopted a programme of needs definition meetings amongst all Bureau branches. These were planned initially for the North Coast, North Western, and Western Regions.

State conference.—The forty-seventh State Conference of the Agricultural Bureau was held at the Australian Academy of Science, Canberra from 7th-9th July, 1971. It was officially opened by the Hon. Ian Sinclair, M.P., Minister for Primary Industry. The conference programme concentrated on rural adjustment and the roles of farmer organizations. One hundred and fifty-three delegates, representing fifty-one branches, attended.

Beef cattle breeders competition.—The Rural Bank of N.S.W. and the Department of Agriculture again co-operated with the Agricultural Bureau in conducting this competition. This year, 107 entries were received, compared with 136 in 1970-71.

Branch activities.—Through its various branches, the Agricultural Bureau of N.S.W. was active in the promotion of educational programmes comprising schools, courses, lectures, field days, and discussions for farmers. Total attendance at the 291 functions recorded was 9,564.

Other Groups

Many organizations in addition to the Agricultural Bureau of N.S.W. were associated with a wide variety of group extension activities. Among these were: United Farmers and Woolgrowers Association; Graziers Association; Primary Producers Union; Australian Society of Animal Production; Service organizations such as Apex; Show Societies; Research and Extension Councils.

Commercial firms were more active than in the past in organizing educational functions, individually or in co-operation with officers of the Department.

Extension officers made greater use of informal discussion groups. These proved highly beneficial to the farmers participating, as well as to extension officers.

The senior extension officer (women's service) assisted in the arrangement of twenty-three 1-day schools for rural women. Eighteen of these were in association with the Agricultural Bureau and five in association with the Country Women's Association.

Group activities.—The following table summarizes group extension activities in 1971–72:

	Number	Attendance
Schools, Symposia, Conferences, Seminars	185	10,221
Field Days	381	18,277
Meetings	620	17,888
Total	1,186	46,386

In all regions, the most numerous and best attended group functions were those dealing with the production of beef, pigs and alternative crops to wheat. Activities dealing with dairying subjects continued to be prominent in coastal areas.

Sheep and wool group activities of a purely technical nature were not favoured because of lack of relevance to the economic situation in the industry. Those activities oriented to whole farm management, including the sheep enterprise, were well supported and appeared to meet the needs of sheep producers.

A significant number of programmes dealt with aspects of farm business management.

A number of functions related to aspects of rural adjustment. Most of these aroused wide spread interest, and some attracted large attendances.

SERVICES FOR EXTENSION OFFICERS

Extension/Research Liaison

In regions.—Regional supervisors reported improvement in liaison between extension and research workers. In some regions there was scope for further improvement. Some extension officers were unfamiliar with research programmes in progress locally which were related to their own disciplines. Also some research officers were unaware of the nature and extent of extension problems within regions that could warrant their attention.

More attention was paid to agribusiness liaison, and although much remained to be done a good basis for development was established by most officers.

The extension/research liaison officer, Armidale, surveyed the liaison situation in the Northern and North Western Regions. Evaluation of the survey information commenced in April, 1972.

This officer also compiled a bibliography of research extension liaison information, and published a directory of research and extension workers in the Northern and North Western Regions.

Research liaison officers (science writing).—The research section of the *Agricultural Gazette* was maintained despite delay in filling the above positions. The research section is intended to give early advice of research results, particularly those of interest to farmers, and to keep readers aware of the Department's research involvement.

Of the two positions, one at the Biological and Chemical Research Institute was filled in February, 1972. This led to a strengthening of the research section of the *Gazette* with reports from that institute. The officer was also able to give advice and assistance in the preparation of research results at the institute, for publication in departmental bulletins and in research journals.

Aids and Services

Display Artist/Design Section.—Displays were prepared for the Royal Easter Show, the Orange National Field Days and the annual poultry field day at Hawkesbury Agricultural College.

Almost 200 signs, display charts and overhead projector transparencies were prepared for the chemistry symposium arranged by the Biological and Chemical Research Institute, Rydalmere. Special weeds plates for colour reproduction and individual cover designs for departmental publications also figured prominently in the section's work for the year.

More officers sought help in the preparation of overhead projector transparencies of professional standard, for use in the presentation of lecture material. This applied particularly to officers travelling overseas.

Photographic Aids Section.—The section was involved in a number of special assignments including the preparation of almost 500 prints of photographs and plant specimens located in the National Herbarium. Also about 150 colour shots were taken to add to the collection of photographs of weeds growing in New South Wales.

Other assignments included visits to research stations for photographs involving technical and developmental projects.

Commonwealth Extension Services Grant.—Audio visual aids and other equipment costing more than \$46,000 was purchased from funds made available from this source, through the Commonwealth Department of Primary Industry, to enhance agricultural extension services.

Items purchased included: 16 mm movie projectors; portable public address systems; projector stands; portable folding blackboards; tape recorders; photocopiers; pocket memo dictation units; transcription units; addressing machines; collators; electronic calculators; milk test equipment; cattle and pig weighing scales.

Additional dictation and transcription equipment and calculators were purchased from Departmental Consolidated Revenue Fund and Government Stores Departmental Group Vote sources, to a total value of some \$4,000.

Some of these items add to the effectiveness of extension work. Others make new projects possible or reduce the time involvement on routine activities.

5. EDUCATION

The administration of four agricultural colleges (and the construction of a fifth) and the provision of several levels of education for prospective farmers and graziers and the technologists to service primary production, continued to be one of the major functions of the Department.

ACHIEVEMENTS AND POLICY CHANGES

RECORD 1972 ENROLMENTS

Total 1972 enrolments reached the record level of 575 compared with 516 in 1971 and 470 in 1969. The fact that progress continued to be made in the objective of providing increasing opportunities for agricultural education at the post-secondary level was particularly noteworthy in the light of the difficulties which have confronted primary producers over recent years.

Facilities were again expanded during the year to provide for additional enrolments as part of the long-term educational programme aimed at improving the efficiency of the State's agricultural industries.

ADVANCED EDUCATION STATUS

Hawkesbury and Wagga Agricultural Colleges were officially gazetted under the provisions of the New South Wales Higher Education Act as colleges of advanced education, operative from 1st January, 1972. All diploma courses at the two colleges were also approved as courses of advanced education in terms of both State and Commonwealth legislation.

Negotiations were commenced for Orange Agricultural College to be granted similar status in 1973.

CAPITAL WORKS PROGRAMMES

Expenditure from funds provided under the States' Grants (Advanced Education) Act and States' Grants (Technical Training) Act amounted to \$1,584,852 compared with \$1,013,237 in the previous year. Details of expenditure on individual projects are included in appendix I (ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1971-2).

The total value of projects completed or almost completed at the five agricultural colleges was almost \$1,600,000. Major works comprised: renovation of student accommodation and food technology tutorial building at Hawkesbury Agricultural College; student accommodation block and college union building at Wagga; and library building at Yanco.

Works under construction had a combined value in excess of \$2,800,000. The major projects involved were: student accommodation block at Hawkesbury; administration building, kitchen-dining room-union building, lecturing-laboratory-library complex, student accommodation blocks, staff flats, essential services and ancillary buildings at Orange; and irrigation laboratory at Yanco.

Working drawings and documentation were completed or almost completed on approved new projects with a combined estimated value of \$2,700,000. Major projects comprised: officers accommodation block at C. B. Alexander Agricultural College; food technology processing block, administration building and apiary at Hawkesbury; staff cottages at Orange; and hydraulics laboratory at Yanco.

Investigations into the production of master development plans were undertaken by the Department of Public Works, in respect of Yanco and C. B. Alexander Agricultural Colleges and taking into account projections for the decade ahead. The development plan for Hawkesbury Agricultural College was also the subject of further investigation rendered necessary by the interest of the National Trust of Australia in the preservation of the stable square and by changes that had occurred in projections on which the original plan had been based.

In accord with development plans, the remaining projects approved for the technical training triennium ending 30th June, 1974 were advanced to the stage of sketch plans. In addition, architectural briefs were provided for the priority projects in the advanced education triennium commencing or 1st January, 1973.

ORANGE AGRICULTURAL COLLEGE

The objective of initial enrolment of students in 1973 became assured with the letting of the second major contract for the construction of the campus buildings at Orange Agricultural College. Tenders were also called for the construction of staff cottages bringing the total commitment on works in progress and under tender to approximately \$2,900,000.

Curricular planning was initiated with the appointment of a board of studies charged with the responsibility of developing prescriptions on which subject syllabuses will be based. The college will present a 2-year diploma course in farm management for those desiring to return to properties where they will undertake managerial responsibilities and become, in effect, the future decision makers of the rural industries.

In consultation with the principal, an adequate number of prospective students commenced acquiring experience on approved properties to ensure admission in 1973.

FEMALE STUDENTS

Although the decision was taken in the planning stages to develop Orange as the State's first co-educational agricultural college, sufficient demand was generated to permit admission of women to all diploma courses in 1971 and to the certificate courses in 1972. This decision was also made in the light of the successful results obtained by women attending the diploma course in food technology as day-students.

In 1972, for the first time, thirty-eight women students enrolled in first-year courses at the four agricultural colleges, bringing the total attendance in all years to forty-eight. Whilst the majority have attended as day-students, limited on-campus accommodation has been provided, where possible, in advance of plans to construct new female accommodation blocks.

DAY STUDENTS

The elective attendance of students on a day-basis proved to be a most successful experiment at the colleges which for years had functioned as wholly residential institutions.

COMMITTEE OF ADVICE

The Committee of Advice on Rural Studies was established in 1967 with responsibilities for the co-ordination and planning of activities in the field of post-secondary agricultural education other than in the universities; planning for the establishment of an institute of rural studies; and undertaking the duties previously the function of the Agricultural Colleges Advisory Committee.

One of the most important contributions made by the committee in recent years has been the setting up of boards of studies and subject advisory committees to review and report on the restructuring of the diploma courses and upgrading of subject content.

These objectives were realized during the year and arrangements were made for the future curricular revisions to become the responsibility of internal college boards of studies. Recognition of the restructuring and upgrading activities has been accorded by State and Commonwealth authorities in approving the diploma courses as courses of advanced education under respective legislation.

Draft legislation was completed and submitted in respect of the New South Wales Institute of Rural Studies.

One of the primary objectives of the Committee has been to provide as complete a range as possible of post-secondary agricultural education at levels appropriate to the particular stage at which formal secondary education has terminated. In addition to the broad structure of diploma awarding colleges of advanced education and certificate awarding colleges, investigations have been commenced in respect of farmer training and post-diploma courses.

COLLEGES OF ADVANCED EDUCATION

COURSES

From the beginning of 1972, all students at Hawkesbury and Wagga Agricultural Colleges were, for the first time, attending diploma courses of advanced education. The last students to attend the old-type courses graduated at the end of 1971.

The restructured courses continued to be vocationally oriented. Practical field work occupied a reduced proportion of the total course but with increased emphasis on formal demonstrations and student projects and assignments. A compensatory increase in the time and depth of treatment occurred in respect of the basic sciences.

Both colleges were converted to the two-semester system from the previous 3-term and 4-term structures. The former rigid curriculum has been replaced by a unit system in the agriculture diploma courses and plans were made for a similar conversion of the technology diploma courses in 1973.

The grade point average system of student assessment was introduced in place of terminal subject examinations.

Agriculture

Of the total of fifty-four students who attempted final examinations at Hawkesbury Agricultural College at the end of 1971, fifty-three were awarded diplomas, including one student who achieved first-class honours and seven students who achieved second-class honours.

At Wagga Agricultural College, forty students out of forty-four graduated at the end of 1971, two achieving first-class honours and four second-class honours.

Dairy Technology

The 2-year course was phased out at the end of 1971, having been replaced by the restructured 3-year course which was introduced at the beginning of 1971. All twelve successfully graduated including two who achieved second-class honours.

Food Technology

The 2-year course was phased out at the end of 1971, having been replaced by the restructured 3-year course which was introduced at the beginning of 1971. Of thirteen students who attempted final examinations, twelve were successful including one with first-class honours and one with second-class honours.

Poultry Technology

The 2-year course which was commenced in 1970 produced the first poultry technology diplomates at the end of 1971 when all three students successfully graduated. The poultry technology board of studies completed investigations into a proposal to extend the course from 2 to 3 years.

Rural Extension

The post-diploma course in rural extension, which was first introduced in 1970, was attended in 1971 by thirteen students who successfully completed their programmes of study, workshops, and project work.

STUDENT ENROLMENTS

The 1972 enrolment of 1st year students in the six diploma courses at Hawkesbury and Wagga Agricultural Colleges was 207 compared with 172 in 1971. Total student enrolment at both colleges in all years also increased from 403 in 1971 to 431 in 1972.

Relative to 1971 statistics, the number of students enrolled at Hawkesbury Agricultural College in 1972 in the agriculture diploma course increased from 58 to 78 in 1st year and from 167 to 177 in all years. At Wagga Agricultural College, 1st year students in agriculture increased from 56 to 64 whilst the total student population remained unchanged at 146.

In the 1-year post-diploma course in rural extension at Hawkesbury Agricultural College, the enrolment of students increased from thirteen in 1971 to eighteen in 1972.

At Hawkesbury Agricultural College also, 1st year and total enrolments in the diploma course in food technology increased from twenty-two and thirty-five, respectively, to thirty-three and fifty-one. In the diploma course in dairy technology, there was a decrease in 1st year enrolments from twenty to seventeen and in total enrolments from thirty-two to twenty-nine. Whilst total enrolments in the new diploma course in poultry technology remained unchanged at ten, the 1st year intake increased from three in 1971 to seven in 1972.

ASSISTED STUDENTS

At Hawkesbury Agricultural College, the 1972 allocation of scholarships, bursaries, and other forms of financial assistance totalled 184 compared with a total student enrolment of 431. All 13 students in the rural extension course were sponsored and the sponsorships to the remaining courses were:

- agricultural diploma course—advanced education scholarships forty, State bursaries and scholarships nine, teacher traineeships thirty-four, public service traineeships fifteen, industry and private scholarships eight, repatriation scholarships five, and aboriginal study grant one.
- dairy technology diploma course—advanced education scholarships four, industry scholarships ten, African assistance programme two, Zambian Dairy Board two, and dairy apprenticeships two.
- food technology diploma course—advanced education scholarships twenty, industry scholarships thirteen, bursaries two, and repatriation scholarships one.
- poultry technology diploma course—advanced education scholarship one and industry scholarships two.

At Wagga Agricultural College, a total of 88 forms of financial assistance was made available in 1972 compared with a total enrolment of 146 students. Sponsorships comprised: advanced education scholarships 29, State bursaries and scholarships 8, public service traineeships 8, teacher traineeships 41, private and industry endowments 2, and repatriation scholarship 1.

COLLEGE UNIONS

The Hawkesbury Agricultural College Union and Wagga Agricultural College Union were formally inaugurated during the year to control the cultural, social, recreational, and sporting activities of the colleges.

SHORT TERM SCHOOLS

The facilities of both colleges were again utilized during vacational periods for the conduct of departmental and external schools, conferences and refresher courses. Included in the non-departmental functions were: an apiary summer school, smallgoods workshop, food plant foreman workshop and refresher schools for stud management and pig producers at Hawkesbury Agricultural College and the annual school for rural youth at Wagga Agricultural College.

FARM AND FACTORY SECTIONS

In association with the restructuring of the diploma courses at Hawkesbury and Wagga Agricultural Colleges, there has been a continuing reorganization of the factory and farm sections with the objective of more effective utilization of these facilities for educational purposes. The primary development has been an increased emphasis on student project work.

At Hawkesbury Agricultural College, the total productivity of the dairy products factory increased by 8 per cent and the value of sales increased from \$348,535 in 1970-1 to \$395,353 in 1971-2. Whilst total sheep numbers fell from 1,440 to 1,094 the value of wool sales increased from \$1,436 to \$4,051. Beef and dairy cattle herds increased from 422 to 477 and from 157 to 169, respectively, and total pig numbers from 208 to 337.

At Wagga Agricultural College, numbers of beef cattle and horses increased respectively from 163 to 223 and from 62 to 70. Sheep numbers remained unchanged at 2,350 and the dairy herd was reduced from 137 to 128.

CERTIFICATE COLLEGES

COURSES

Certificate courses in agriculture were conducted at C. B. Alexander and Yanco Agricultural Colleges. Advanced certificate courses, commenced in 1971, were also presented in cattle husbandry at C. B. Alexander and in irrigation at Yanco Agricultural College.

Agriculture

Of the forty-nine students who attempted final examinations at Yanco at the end of 1971, thirty-eight were awarded certificates.

At C. B. Alexander Agricultural College, thirty-two out of thirty-seven were successful in gaining certificates.

Both courses continued to provide intensive training in practically oriented management training for young men and women with intentions of returning to the land to ultimately manage properties.

Irrigation

In the inaugural year of the Yanco advanced certificate course in irrigation, all twelve students were successful in gaining certificates. All private students returned to manage irrigated enterprises whilst in-service training officers gained materially in knowledge of irrigation practices prior to district appointments.

Cattle Husbandry

Of the ten students who attempted final examinations at the end of the inaugural advanced certificate course in cattle husbandry, nine were successful in gaining certificates.

STUDENT ENROLMENTS

The total enrolment in the four one-year certificate courses at Yanco and C. B. Alexander Agricultural Colleges increased from 122 in 1971 to 146 in 1972.

At Yanco Agricultural College, there was a reduced enrolment in the agriculture certificate course from fifty-one in 1971 to forty-six in 1972 and in the advanced irrigation certificate course from twelve to eleven.

However, enrolments increased at C. B. Alexander Agricultural College from fourteen to twenty-nine in the advanced certificate course in cattle husbandry.

For the first time, female students enrolled at both colleges—two at Yanco and six at C. B. Alexander.

ASSISTED STUDENTS

In 1972, six students at Yanco were in receipt of financial assistance, three with technical scholarships, two from the soldiers' children education board and one from the Department of Primary Industry.

At C. B. Alexander Agricultural College, fifteen students were in receipt of technical scholarships and two were repatriation beneficiaries.

FARM SECTIONS

At C. B. Alexander Agricultural College, beef cattle numbers increased from 969 on 30th June, 1971 to 1,059 on 30th June, 1972 and the value of sales increased from \$15,134 in 1970-1 to \$45,268 in 1971-2. Dairy cattle numbers increased from 216 to 222 and milk production from 895,292 lb to 906,371 lb.

At Yanco Agricultural College, beef cattle and dairy cattle numbers increased respectively from 121 to 125 and 95 to 117 whilst sheep numbers fell from 1,919 to 1,320. Income from the livestock sections increased from \$16,935 to \$17,685.

6.1 REGULATORY AND TECHNICAL SERVICES: PLANTS AND PLANT PRODUCTS

REGULATORY SERVICES

PLANT DISEASES ACT

Amendments

Major amendments to this Act, contained in the Plant Diseases Amendment Act 1971, have (a) widened its scope, (b) provided for simplified procedures in issuing orders for compulsory control of specified pests and diseases and in updating existing compulsory measures, and (c) introduced new procedures for dealing with breaches of grading regulations for fruit and vegetables. The broadened scope of the Act makes it more effective for dealing with new outbreaks of exotic pests and diseases. Regulations and orders to bring into effect the other changes are being drafted. Grading regulations generally are also being reviewed and amended to extend their application to the retail level. The new potato regulations have been drafted and the new citrus and pome fruit regulations will go forward in the near future.

Restricted Areas

New proclamations were made during the year in respect to restrictions on the entry of fruit, vegetables, plants, and secondhand packages into certain areas of the State. The southwestern districts comprising Curlwaa-Coomealla and Euston were consolidated into one area, the Murrumbidgee Irrigation Area zone was extended to incorporate Murrumbidgee Shire, and the restricted area in respect to rice was extended to incorporate all shires in which rice is produced and including some buffer zones.

New restrictions in the Curlwaa-Coomealla-Euston area have resulted in controls being placed on the entry of secondhand fruit cases. Seizures of illegally introduced boxes at the Euston road block totalled 1,500 and a number of prosecutions have been initiated. A new road block, operated in conjunction with the Victorian Department of Agriculture, was established on the Silver City Highway north of Wentworth. Vine cuttings permitted entry into the Curlwaa-Coomealla area totalled 460,000, while in this same area 800,000 vine rootlings were hot water treated under check supervision for nematode eradication.

Illegal entries of secondhand boxes and fruit into the Murrumbidgee Irrigation Area showed some increase, resulting in a higher number of prosecution proceedings. Much of the increase in illegal box entries was associated with trade in marketing wine grapes in Sydney and Wollongong. Permit entry of fruit into Leeton totalled 17,466 packages of bananas and 4,219 packages of apples.

Quarantine Areas

A new quarantine area was notified on the Far North Coast due to the presence of citrus leaf miner (*Phyllocnistia citrella*). The notification prohibits removal of citrus plant material from the area, restricts internal movement, and introduces compulsory control measures.

The banana bunchy top eradication programme has been reviewed to provide better deployment of the bunchy top detector gangs. The incidence of bunchy top detected compared with last year was:

<i>District</i>				<i>Number of Infected Plants</i>	
				1970-1	1971-2
Tweed	..	..	..	862	847
Brunswick	..	..	..	251	126
Richmond	..	..	..	12	4
				1,125	977

Stored Products Pests

Increased attention was given during the year to infestations of stored products pests in storages in close proximity to Grain Elevators Board receival depots. Some difficulty was encountered in resolving responsibilities in single storage facilities with more than one occupant, causing some delays in obtaining remedial action. However, in all occurrences dealt with, satisfactory results have been achieved and only in isolated instances was it necessary to exert pressure to gain co-operation.

Fruit Fly

Following the occurrence of Queensland fruit fly (*Strumeta tryoni*) in Broken Hill, Menindee, and Balranald, additional inspections were made of these towns culminating in a team of officers conducting a detailed inspection for a final clean-up for the season, to reduce the risk of carry over to the following season. In Broken Hill alone over 3,000 home gardens were inspected. Co-operation from local government bodies was considerable.

The increased occurrence of Queensland fruit fly throughout most of the State was reflected in increased incidence in many towns conducting town treatment programmes. Unfortunately in a number of towns council staff did not appear to appreciate the need to apply control measures regularly and on schedule. As a result bait sprays were sometimes omitted at critical periods. Other factors which tended to reduce the effectiveness of the programme were the frequent rainy periods in many districts during summer and early autumn and the carry over from the high incidence of fruit fly the previous year. Nevertheless, reports from most areas indicate a marked suppression of populations. A total of forty-nine towns were treated with bait sprays. New towns to participate were Wilcannia and Gulgong (rejoining after a lapse). Assessment rating of the level of infestation is not directly comparable between towns, as the rating is relative to normal situations for the locality and therefore varies. However, an assessment of the situation in the forty-nine towns indicated eight towns free from infestation, twelve towns with very light infestation (from one to few fruit only), nine with light infestation, twelve with moderate infestation (usually patchy and late in the season), and eight towns with heavy infestation (mostly mid to late season only).

Fruit fly was also detected in the M.I.A., resulting in restrictions on the export from that area of citrus to New Zealand.

Banana Weevil Borer

The inspection programme for banana weevil borer (*Cosmopolites sordidus*) has continued throughout the quarantine area. Further areas infested with dieldrin-resistant borers were found at Yelgun, Burringbar, and Coopers Creek in the Brunswick district; at Tullera, Durroughby, and Rosebank in the Richmond district; and at Doon Doon, Eungella, and Dunbible in the southern sections of the Tweed. Further spread of borer infested areas has occurred in the Coffs Harbour and Nambucca districts.

Potato Powdery Scab

Powdery scab (*Spongospora subterranea*) was detected for the first time in N.S.W. since 1933. As a result the infected property at Ebor was placed under quarantine. Approximately 5,000 bags of interstate potatoes marked in N.S.W. were found to be infected with powdery scab and action was taken to prevent dispersal of the disease.

Neglected Orchards

Subdivision, and land purchased for ultimate subdivision, in orchard areas adjacent to the Sydney metropolitan area and in the Central Coast district continue to cause concern and action resulted in the destruction of thirty-two former commercial orchards and nine smaller plantings.

Immature Fruit

Action was taken to prevent the sale of some 2,000 packages of interstate apples which had been marketed too early, and of 950 packages of immature grapes.

FRUIT CASES ACT

No new packages have been prescribed under this Act. However, sections of the fruit industry are still experimenting with and considering various packages for ultimate adoption and gazettal. At the end of the year, six packages which have not been prescribed were in use under permit for extended trial purposes. In addition, a further five had been approved on a restricted basis for trial purposes for 1 year. Fruits involved are citrus, apples, pears, bananas, pineapples, and nectarines.

HORTICULTURAL STOCK AND NURSERIES ACT

The regulations and proclamations necessary under this Act should come into effect during 1972-3.

POTATO GROWERS' LICENSING ACT

The number of licences issued was 1,068, compared with 1,058 in 1969-70 and 1,152 in 1970-1. Licence fees have been increased from \$4 to \$10 and amendments to the Act in process will reduce the maximum non-licence area from 1 acre to $\frac{1}{4}$ acre. Following a review, licensing administrative procedures are expected to be streamlined.

QUARANTINE ACT (COMMONWEALTH)

Administration

Advice on plant quarantine policy is tendered to the Commonwealth Department of Health by Departmental specialist officers. In particular, senior plant pathologists attended meetings called by the Department of Health to consider applications (1) by a Canadian Apple Mission to allow the importation of apples from Canada, and (2) to introduce a strain of powdery mildew (*Erysiphe cichoracearum*) as a biological control agent against skeleton weed. Both applications were opposed—the former because of inadequate safeguards to prevent the destructive disease fireblight being brought into Australia, and the latter because the introduction could result in the occurrence of powdery mildew on plants of economic importance in Australia.

The plant quarantine provisions of the Act are administered in N.S.W. by the Division of Horticulture through its Export and Import Branch on behalf of the Commonwealth Department of Health. During the year, a major review of quarantine entry permit procedure was undertaken with the Department of Health. As a result the processing of documents by Customs Agents between the Plant Quarantine Service and the Department of Customs is being simplified. Following another review, the requirement of quarantine permits for pallets constructed of wood was removed, considerably reducing the number of permits to be processed.

An additional position for supervising inspector (plant quarantine) was created to provide for more adequate supervision made necessary by the increasing volume and complexity of operations.

Plant Quarantine Station

The Plant Quarantine Station at Rydalmere has been enlarged by the addition of another glasshouse. Construction is well advanced on a birdproof outdoor growing area, and the first stage of the head house-office laboratory building has been completed. Also under construction are mist propagation benches and installation of mercury vapour daylight lamps. With these additional facilities the capacity and efficiency of the Station will be improved.

Nursery Stock Imports

An increase over last year of 394 plants gave a total of 11,451 plants and 289 rose budding eyes dealt with under nursery stock regulations. These consisted of 5,668 orchids, 2,520 succulents, 877 ornamentals, 157 aquatic plants and 279 bulbs and rhizomes. The number of succulents (including cacti) showed a considerable increase, from 1,463 in the previous year to 2,520. Little trouble was experienced from pest or disease infection. Mites, scale insects and mealy bugs were the main insects detected while virus in carnations and orchids was the most prevalent disease.

Parcel Post

The number of parcels examined increased by 2,669. A total of 13,966 packages were held for examination and of these 2,214 were detained for further examination and treatment or destruction.

Overseas Passenger Vessels

One hundred and ninety-seven commercial passenger and naval vessels from overseas were attended, a reduction of 83 on the previous year. Articles held for treatment or destruction totalled 224.

Overseas Flights

Overseas flights into Mascot terminal increased from 7,950 to 9,240. However the number of passengers decreased from 714,863 to 627,305. During the period 21st September, 1971 to 30th May, 1972 the number of calls from Customs for quarantine examination of articles was 24,970. Goods detained and forwarded to Export and Import Branch for decision decreased from 249 to 186. Goods intercepted and destroyed at Mascot included the following:

Fruit

Pome	4,106
Tropical	3,121
Citrus	4,045
Stone	325 lb
Grapes	230 lb
Litchi	80 lb
Olives—Green	35 lb
Dried fruit	408 lb

Vegetables

Garlic	133 lb
Onions	84 lb
Other vegetables	375 lb

Nuts

Chestnuts	280 lb
Walnuts	590 lb
Raw peanuts	40 lb
Other nuts	77 lb

Seed

Wheat	92 lb
Maize	204 lb
Beans	601 lb
Vegetable—Flower	2,305 pkts

Plants and Cuttings, etc.

Ornamental	1,486
Commercial fruit	1,402
Bulbs	418 pkts
Flowers	230 bunches
Mushrooms	423 pkgs
Soil	347 pkgs
Fruit cases	98
Straw packing	151 pkgs
Herbs	295 pkgs
Raw cotton	17
Wood—Bamboo	121

Incoming flights attended at Richmond RAAF Air Base increased from 487 to 547, passengers from 6,705 to 7,212 and freight from 15,452,000 lb to 17,768,000 lb. General cargo was in a much cleaner condition with fewer quarantine problems. U.S.A.F. household effects on consignment to Woomera and Alice Springs increased markedly in volume and some items required quarantine attention. The quarantine facility at the base has been further improved, and co-operation by the RAAF and U.S.A.F. personnel located at Richmond has been very good.

General Wharf Inspections

Overseas cargo vessels serviced totalled 927 compared with 1,014 in the previous year. Goods inspected (with the previous year's figure in brackets) included the following:

Motor vehicles 26,047 (34,289) of which 4,128 (4,753) required steam cleaning.

Soybean meal 231,047 (95,840) bags of which 79,035 were fumigated for insect infestation.

Phaseolus bean seed for processing, etc. totalled 23,914 (29,119) bags.

Peanuts and walnuts totalled 905,672 lb of which 32,288 lb were fumigated for insect infestation.

Other nuts totalled 3,072,000 lb of which 44,047 lb required fumigation.

Cotton imports increased to 48,474 (39,286) bales of which 689 were ordered for fumigation.

Copra imported and processed under supervision totalled 21,463 (23,810) tons of which 7,529 (3,990) tons were fumigated due to heavy insect infestation.

Pasture seed imports increased to 23,056 (17,695) sacks of which 586 required quarantine action.

Jute waste imports totalled 2,208 bales.

Timber

Imports increased considerably from 190,500,000 super feet the previous year to 351,244,000 super feet, due mainly to increases in Douglas Fir from North America.

Imports of logs declined by 50 per cent while plywood imports increased by 500 per cent. The quantity of timber which required quarantine treatment was:

	<i>su ft</i>				
Meranti	2,862,545				
Kalantas	10,000				
Pinus radiata	12,000				
S.E. Asia logs	1,176,036				
Douglas fir	135,382				
Mahogany	562,372				
Hemlock	2,418,893				
Kauri pine	287,623				
African hardwood	10,052				
Surayah	11,472				
	7,486,375				

The main insect infestations were *Platypodidae* in hemlock, *Bostrychidae* and *Lycitidae* in S.E. Asian hardwoods, and *Scolytidae* in logs from S.E. Asia.

Containerised Cargo

The volume of traffic in containers continued to increase. A new depot opened at Rozelle and a depot at Newcastle is ready for operation. The number of container vessels plying to the Port of Sydney has increased from twenty-four to twenty-eight, with thirteen vessels on the United Kingdom-Europe run, eight to Japan, six to the U.S.A. and one to New Zealand.

A total of 63,110 containers were landed in Sydney from container vessels and a further 16,419 from conventional cargo vessels. Approximately 30,000 containers were placed on the immediate delivery list following manifest perusal. Of these 398 were given a follow-up inspection and 22 found to be incorrectly manifested. The remainder of the containers were directed to depots for unloading and inspection, where 642 were found to require some quarantine action due to infestation or contamination.

Household Effects, Furniture, etc.

These items are subjected to quarantine inspection by appointment at approved premises in the metropolitan area, the main concern being the use of straw packing and borer infestation in timber. At Grace Bros Bond, 4,123 consignments comprising 49,813 cases totalling 701,697 cu ft were inspected, and at the Department of Supply, 1,540 consignments comprising 1,021 cases totalling 326,181 cu ft. Other appointment inspections included 760 consignments of household effects, 120 consignments of new furniture, 30 of artifacts, 75 of musical instruments including pianos, 60 of woodware and 50 of Chinese foodstuffs.

Approved Processors

Imports of cotton, peanuts, copra, beans, linseed, and similar products restricted under quarantine legislation are processed under quarantine supervision. Also included in this category are certain approved laboratories analysing soil samples brought in from overseas. Regular inspections of these premises were made throughout the year.

Customs Liaison

To maintain quarantine control and to expedite movement of cargo unloaded onto wharves requires close liaison with the Customs Department. A quarantine officer is specifically assigned to this duty. During the year 950 overseas vessels were listed for undelivered goods being removed from the wharves to bond stores.

Quarantine Treatments

Many imported goods must undergo some form of disinfection treatment before delivery can be permitted. The treatments, which include heat treatment, fumigation, steam cleaning, seed cleaning, destruction of packing material, etc., are conducted at approved premises under the supervision of a quarantine officer.

Inspections at Export and Import Branch

Where necessary and for expediency, certain imports are directed to the Export and Import Branch for inspection and treatment. This action was taken on 6,443 consignments of which 1,295 were found to require quarantine action.

General

In past years overall quarantine activity has been measured in terms of the number of quarantine permits issued. The number of permits issued in 1971-2 totalled 51,167. The removal of pallets from the list of items requiring a permit has rendered invalid any comparison with previous years.

Quarantine interceptions of insect infestations included the important stored product pests *Trogaderma granarium* (Khapra beetle) and the related *Trogaderma glabrum*, neither of which is present in Australia. The former was found in coriander seed and celery seed from India, and the latter in soybean meal from the U.S.A. Carpenter ants (*Camponotus pennsylvanicus*) were intercepted on a number of occasions in cargo from North America. One hundred and nine samples of infestations were referred to the Entomology Branch for confirmation and/or identification.

A total of 2,826 quarantine specimens of plants and plant parts were examined by the plant pathologist (quarantine), and prescribed quarantine treatments were given where necessary. In many instances follow-up inspections were made of plants grown in quarantine from these importations.

Of 464 quarantine samples of seed examined in the Seed Testing Laboratory, 106 samples contravened one or several provisions of the Act, 66 containing prohibited weed seeds, 78 excessive quantities of restricted crop seeds and 36 excessive quantities of earth. Two hundred and three packets of seed (trade and experimental samples) and 3 portions of small lots were hand-cleaned to facilitate release.

COMMERCE (TRADE DESCRIPTIONS) ACT (COMMONWEALTH)

The Division of Horticulture, through its Export and Import Branch and district inspectors (Plant Diseases Act), administers in N.S.W. on behalf of the Commonwealth Department of Primary Industry, the Exports (Fresh Fruit) Regulations, Exports (Fresh Vegetables) Regulations, Exports (Grain) Regulations, Exports (Flour) Regulations, and Exports (General) Regulations in respect to plants, seeds, and field peas.

Exports (Grain) Regulations

These apply to exports of wheat, oats, barley, and sorghum, of which only wheat and sorghum are of any consequence in exports from N.S.W., as the following statistics show:

	Sydney	Newcastle	Total
Wheat ship surveys	103	59	162
Ships rejected at initial survey	32	22	54
Bulk wheat (tons)—			
Loaded	1,917,963	431,824	2,349,787
Rejected	14,826	21,085	35,911
Bagged wheat (tons)—			
Loaded	663	530	1,193
Rejected	Nil	Nil	Nil
Barley (tons)—loaded	Nil	Nil	Nil
Oats (tons)—loaded	Nil	Nil	Nil
Bulk sorghum (tons)—			
Loaded	Nil	299,455	299,455
Rejected .. .. .	.. .. .	Nil	Nil
Bulk maize* (tons)—			
Loaded	Nil	6,285	6,285
Rejected .. .. .	.. .. .	Nil	Nil
Milled rice* (tons)—loaded	53,600	Nil	53,600

* These grains are not subject to the Exports (Grain) Regulations, but were inspected for phytosanitary certification or for other purposes.

Substantial quantities of malted barley, which were inspected at Corowa and shipped in containers ex Melbourne, involved a total of more than seventy inspections. The first shipment from eastern States of lupin seed totalled 1,418 tons and was made in containers from Wagga to Kobe, Japan.

Exports (Flour) Regulations

Flour shipments through the Port of Sydney totalled 40,614 tons which is 41,421 tons less than last year, due principally to reduced supplies to Colombo. Rejections mainly for damp and discoloured bags were 931 x 50 lb bags, 1,818 x 120 lb bags and 45 x 140 lb bags. Export flour was also shipped from Tocumwal and Narrandera in containers through Melbourne, although the former mill has now withdrawn from the export trade.

Exports (General) Regulations

The principal items submitted for inspection were 8,103 packages of pasture seeds, 2,688 packages of field peas, 2,829 of vegetable and flower seeds, 1,204 of tree seed, 1,577 of cereals (sorghum, popcorn, etc.), 29 of nuts and 54 of plants.

Exports (Fresh Fruit) and (Fresh Vegetables) Regulations

The general standard of produce presented for export was good. However, rejections were fairly heavy in some vegetable lines, mainly due to the presence of soil, especially in potatoes for which there were also some rejections due to insect infestation. The following statistics cover shipments out of Sydney, including produce forwarded from other States but do not include N.S.W. produce exported through Melbourne or Brisbane. A feature of the trade is the large number of relatively small shipments to Pacific Island ports involving a wide range of commodities.

Quantities exported were:

Apples	98,121 bus	Nectarines	6,106 pkgs
Pears	99,163 cases	Cherries	8,033 $\frac{1}{4}$ bus
Oranges	108,117 bus	Grapes	19,652 $\frac{1}{2}$ bus
Mandarins	10,800 $\frac{1}{2}$ bus	Tomatoes	32,176 $\frac{1}{2}$ bus
Lemons	4,776 bus	Strawberries	3,014 ctns
Grapefruit	2,678 bus	Potatoes	92,880 bags
Apricots	2,469 pkgs	Onions	124,172 bags
Peaches	23,079 pkgs	Garlic	1,698 bags
Plums	14,088 pkgs	Other vegetables	74,572 pkgs

General

The number of export permits issued were:

	1970-1	1971-2
Fruit	1,742	2,083
Vegetables	2,286	2,407
Flour	593	593
Grain	180	217
General	237	340
	5,038	5,640

Five thousand one hundred and eighty-one phytosanitary certificates were issued in 1971-2 covering 136,551 packages, compared with 5,916 and 185,935 respectively in the previous year.

PEST DESTROYERS ACT

The newly formed Pest Destroyers Committee met regularly to consider applications for registration, and for variations to registrations, of products under the Pest Destroyers Act. Registrations expire on 30th September each year and for the first 9 months of the current period 1,533 applications were considered, of which 415 were for new products or variations of existing products. The committee has continued to take particular account of such factors as environmental pollution, general health aspects and other matters such as insecticide resistance. Inspectors (various Acts) detected twelve unregistered pesticides during the year.

A draft of a revised Act has been prepared and is currently under consideration by appropriate Government and industry bodies.

FERTILIZER ACT

Regulations for the implementation of the Fertilizers (Amendment) Act were gazetted on 28th April, 1972. Provisions of the Act which will come into force on 1st January, 1973, include the expression of phosphorus and potassium as the elements and not as P_2O_5 and K_2O .

About one-third of twenty-six samples collected by inspectors (various Acts) of blood and bone fertilizers being marketed were found, on analysis, to contain urea. Registration is not permitted of any blood and bone fertilizer which contains urea and any such fertilizer will not be re-registered. Three unregistered fertilizers were detected during the year.

AGRICULTURAL SEEDS ACT

Of 121 samples representing 25 crop species taken and tested under this Act, 94 samples conformed and 27 failed to conform to minimum requirements. Warnings were issued for eight breaches of the Act.

TECHNICAL SERVICES

SEED PRODUCTION

Seed production officers located in the main seed producing centres, together with district agronomists throughout the State, supervised the production of registered cereal seed and of certified seed of pasture species, maize, sweet sorghum, and potatoes.

Foundation and Registered Cereal Seed

Supplies of pure seed (foundation seed) of recommended and promising cereal varieties were increased on eight research stations and distributed to registered seed growers throughout the State—this involved 195 acres of wheat, 65 acres of oats and 34 acres of barley, compared with 165, 103, and 34 acres respectively in 1970–1. Of a total of 323 (337 in 1970–1) Registered Seed Growers, 162 (171) increased seed of 14 (15) wheat varieties, 112 (126) increased seed of 11 (12) oat varieties and 49 (40) increased seed of 11 (10) barley varieties. The Department maintained stocks of the rye varieties Weethalle and Strain 8 and distributed seed of both to co-operating farmers for seed increase and distribution to other growers.

Certified Pasture Seed

The existence of large stocks of carry-over seed from 1970–1 followed by unfavourable seasonal conditions in 1971–2 resulted in a total production of certified pasture seed of 512 tons, compared with 2,338 tons in 1970–1.

Subterranean clover.—Production of certified subterranean clover seed (*Trifolium subterraneum*), which was confined to southern districts of the Riverina, totalled 120 tons (1,623 tons in 1970–1), comprising Woogenellup 44 tons, Mount Barker 44 tons, Dwalganup 28 tons, and Tallarook 4 tons.

Barrel medic.—The total production of 27 tons of certified seed of the Jemalong cultivar of barrel medic (*Medicago truncatula*) was harvested from one area of 500 acres which had a potential total yield of 90 tons before the onset of very wet conditions during harvest.

Lucerne.—Certified lucerne (*Medicago sativa*) seed production amounted to 211 tons of the Hunter River cultivar, the bulk being harvested from irrigated crops in the central west and from dryland crops in the south east Riverina. Heavy summer rains, weeds, and insects were responsible for reduced yields which varied from 323 lb per acre from irrigated crops to 9 lb per acre from dryland crops. Many seed lots contained a high proportion of hard seeds and required scarification treatment. Several lots containing seeds of dodder (*Cuscuta* spp.) were withdrawn from certification.

Perennial ryegrass.—The total production of 70 tons of certified seed of perennial ryegrass (*Lolium perenne*) was of the Kangaroo Valley cultivar. Heavy rains during harvest reduced the average yield to 245 lb per acre.

Phalaris.—Adverse weather conditions were primarily responsible for a further decline in production of seed of all phalaris (*Phalaris tuberosa*) cultivars. The production of certified seed of Australian phalaris amounted to 25 tons, Seedmaster 5 tons, and Sirocco 3 tons.

Tall fescue.—Weather conditions favoured seed production of tall fescue (*Festuca arundinacea*) and the production of 51 tons of certified seed of the Demeter cultivar represented a 25 per cent increase on last year.

Cocksfoot.—Production of certified seed of the Currie cultivar of cocksfoot (*Dactylis glomerata*) amounted to 1 ton, compared with 6 tons in 1970–1.

Broadleaf paspalum.—Adverse seasonal conditions reduced certified seed production of broadleaf paspalum (*Paspalum wettsteinii*) to 3 tons.

Kikuyu.—15 cwt of certified basic seed of the kikuyu cultivar, Whittet, was produced during the year. This seed was resown over some 3,000 acres for further certified seed production.

Hybrid Maize

Production of certified hybrid maize seed totalled 363 tons.

Sweet Sorghum

Twenty-five tons of certified sweet sorghum seed were produced.

Potatoes

Seventy-seven growers grew 813 acres of certified seed potatoes, and twenty growers grew 282 acres of approved seed potatoes.

SEED TESTING

The number of samples submitted to the Seed Testing Laboratory increased by 14 per cent from 2,781 in 1970-1 to 3,171 in 1971-2. Categories in which increases were recorded were quarantine (464 samples submitted), regulatory (124), certified maize, sorghum, and beans (483), rice industry (58), miscellaneous industry samples (699) and seeds submitted by other Departments (82). The increase in the last category was due to a new venture of testing tree seed on behalf of the Forestry Commission and a greater use of the service by the Police and Customs Departments, mainly in relation to seeds of drug plants. The increase under miscellaneous industry samples was largely due to an increase in oil seed samples. Cotton seed testing was resumed and 191 samples received. The number of certified pasture species samples fell to 329 due to adverse seasonal conditions. Six hundred and seventy-two samples were submitted by Departmental officers and sixty-nine seed samples were received for identification purposes. The time of test (from date of receipt to date of report) for the high priority certified and quarantine samples was further reduced.

AUSTRALIAN INOCULANTS RESEARCH AND CONTROL SERVICE

This service was established and financed by Australian Agricultural Council to control the quality of legume seed inoculants during production and in retail outlets in all States. Rhizobium broth cultures submitted by inoculant manufacturers for testing prior to impregnating the peat carrier totalled 352 of which 294 were satisfactory. Of 241 batches of inoculants prepared and submitted for test prior to sale, 169 were satisfactory. A total of 516 samples of inoculants were purchased at point of sale in all states, and 284 of these found to be satisfactory.

NOXIOUS PLANTS

The State Government made available \$650,000 to the Department of Local Government in 1971-2 for distribution, on the joint recommendation of the Ministers for Agriculture and Local Government, to councils and Pastures Protection Boards for the control of noxious plants. Galvanized burr control programmes continued to receive major support and Pastures Protection Boards and councils were allocated \$95,250 on a \$2 for \$1 basis. The remaining funds were granted to councils throughout the State to control blackberry, serrated tussock, groundsel bush, bracken, boxthorn, and nodding thistle.

The Indian hemp (*Cannabis sativa*) eradication programme was continued in the Hunter River valley and regular inspections showed the situation to be satisfactory. An outbreak of opium poppy (*Papaver somniferum* subsp. *hortense*) which was discovered in the metropolitan area was destroyed through the co-operation of the Police Department and the council concerned.

Revisions of noxious plants lists for the State were completed except for the Sydney metropolitan area.

PLANT DISEASE FORECASTING SERVICE

During the 1971-2 season, the Department co-operated with the Regional Director of Meteorology in the institution of a Disease Forecasting Service for the control of scab disease of apples and pears on the Murrumbidgee Irrigation Areas. This represented an extension of the Disease Forecasting Service previously operated for the control of brown rot disease of stone-fruits on the M.I.A. The warning service for apple and pear scab control consisted of a pre-infection warning to enable growers to apply a protective fungicide and a post-infection warning to enable growers to apply a curative fungicide. Appropriate warnings when spray applications were necessary were issued over the local television and radio stations.

PLANT HEALTH DIAGNOSTIC SERVICES

A total of 2,998 specimens of plants were examined for presence of disease and control measures recommended where necessary. Nine hundred and ninety-six specimens were similarly examined for insect pest problems. Approximately 1,000 soil and plant samples were examined for the presence of plant parasitic nematodes.

NEW PLANT DISEASES

Over sixty new records of plant diseases were made during the year. The most spectacular was the rust disease of matchwood poplars, *Populus deltoides*, caused by the fungus *Melampsora medusae*, Thum. First recorded in late January, 1972, in the Wiseman's Ferry district, it spread rapidly and within 4 months was present throughout the entire eastern half of the State. Severe premature defoliation occurred on infected trees. On maize the disease southern leaf blight caused by the fungus *Drechslera maydis* was recorded on the North Coast of N.S.W. on varieties with Texas cytoplasm. It occurred late in the season and its effect in N.S.W. will need to be estimated in subsequent growing seasons. Other diseases recorded included onion rust (*Puccinia allii*) and skeleton weed rust (*Puccinia chondrillina*). The latter species was introduced by CSIRO as a possible biological control agent for skeleton weed.

6.2 REGULATORY AND TECHNICAL SERVICES: ANIMALS AND ANIMAL PRODUCTS

REGULATORY DISEASE CONTROL

Tuberculosis

Progress continued to be made in reducing the incidence of tuberculosis. Most testing was undertaken under either the protected area scheme or the quarantine area scheme. The former applies to the more closely settled coastal districts in which the testing of all cattle, both beef and dairy, is compulsory. The quarantine area scheme, which applies in the remainder of the State, consists in constituting as quarantine areas, properties containing herds which are found to be infected or suspected of being infected.

Throughout the State, all cattle being sold are required to bear a tail tag identifying the property of origin, so that in the event of tuberculosis being detected at slaughter, the remainder of the herd can be tested. Previously, owners of four cows or less were exempt from the application of such tags but during the year regulations were altered limiting the exemption to owners of one head of cattle.

The number of cattle found infected at abattoirs and successfully traced by their tail tags both within and outside protected areas was 199. These came from 23 dairy farms and 176 beef holdings. The number within protected areas was 57 while 142 were in the remainder of the State.

Routine tests in protected areas and initial tests of quarantined herds are carried out at Government expense by approved private veterinary practitioners where available. If reactors are detected, retests are undertaken by departmental officers until two complete negative tests have been obtained except where the reactors fail to show lesions of tuberculosis on slaughter when only a single retest is performed.

The total number of tuberculin tests performed during the year for all purposes was 1,076,349 of which 1,648 or 0.15 per cent proved positive. Of these 643 or 38.41 per cent did not show lesions on slaughter. No visible lesions reactors represented 0.085 per cent of cattle tested. Of those tested, 37 per cent were dairy cattle and 63 per cent beef animals.

Because of Commonwealth export licensing requirements, a number of country abattoirs refused to accept reactors for slaughter creating problems in salvaging the carcasses of these animals and sometimes necessitating reactors being trucked hundreds of miles to abattoirs. The practice was continued as far as possible of having specimens of suspected tuberculosis lesions found at abattoirs subject to laboratory examination. The number of specimens so examined was 450 of which 322 were confirmed as being due to tuberculosis. The most common diagnoses of non-tuberculous lesions were actinobacillosis, abscesses, squamous cell carcinomata and parasitic granulomata.

A proclamation was gazetted, restricting the introduction of cattle into New South Wales from tuberculous herds in other States and providing for testing of such cattle before introduction.

Protected area scheme.—There are nineteen protected areas all of which embrace the more closely settled coastal districts with the exception of one area in the southwest of the State where an appreciable number of dairy farms exist on irrigated properties. The areas contain approximately 2 million head of cattle with about equal numbers of dairy and beef animals. Tests performed totalled 868,299, representing a significant increase on the previous year's figures of 707,907. Of the cattle tested, 580 or 0.067 per cent were positive, a figure similar to that of 0.062 per cent obtained during the previous year. There was a rise from 42,620 to 66,454 in the number of cattle requiring retest on account of the detection of the reactors.

Lesions of tuberculosis were not found in 37.24 per cent of reactors, a significant reduction on the previous year's figure of 50.0 per cent. No visible lesion reactors represented 0.025 per cent of cattle tested, a reduction on last year's figure of 0.031 per cent.

Because of the lowered incidence of tuberculosis, the interval between routine tests has been extended to 4 years for areas containing some two-thirds of the cattle population of protected areas. The balance remained on 2-year testing. Particulars of testing in protected areas are summarized in the accompanying table.

Tuberculin testing in protected areas

Purpose of test				No. of cattle tested	No. of reactors	Reactors %	No. of reactors *NVL	Reactors *NVL %
Routine tests	..	..	..	747,306	187	0.025	92	49.02
Retests	..	..	..	66,454	381	0.57	113	29.66
Introductions	..	..	..	54,539	12	0.022	11	91.67
Total	..	..	..	868,299	580	0.067	216	37.24

* NVL = No visible lesions.

Quarantine area scheme.—Approximately four million cattle, almost entirely beef animals are involved in this scheme which embraces that part of the State not included within protected areas. Particulars of testing are shown in the accompanying table.

Tuberculin testing in quarantine areas

Test			No. herds tested	No. cattle tested	No. reactors	Reactors %	No. reactors *NVL	Reactors *NVL %
Initial	..	..	211	67,379	713	1.06	245	34.36
Retest	..	..	231	70,667	325	0.46	150	46.15
Total	..	..	452	138,046	1,038	0.75	395	38.07

* NVL = No visible lesions.

No visible lesion reactors totalled 59.1 per cent of positive dairy cattle and 36.5 per cent of positive beef animals and represented 0.02 per cent of cattle tested. The number of herds placed in quarantine during the year was 204 while 188 were released from quarantine. Thirty-three herds remained in quarantine for the full year.

Tubercle-free herd scheme.—In this scheme of voluntary accreditation, 42 herds containing 7,607 head of cattle were tested. There were four reactors, none of which showed lesions of the disease. A further thirteen herds accredited during the previous year for 2 years were not tested.

Tubercle-free milk schemes.—These schemes involve herds from which milk is sold unpasteurised. One scheme, which applies to the large cities, is administered by the Dairy Industry Authority. Under this scheme 554 cattle were tested in seven herds. There were no reactors. Municipal and Shire Councils supervise the other scheme which covers small cities and towns. Cattle tested numbered 210, all being negative.

Much of the testing formerly carried out under these schemes has been incorporated within the protected area scheme.

Miscellaneous tuberculosis testing.—The number of cattle tested voluntarily for interstate and overseas movements and for other purposes was 61,733. There were 26 reactors of which 19 did not show lesions of tuberculosis.

Tuberculosis (Pigs)

Fourteen herds were placed in quarantine on account of this disease while quarantine was maintained on a further herd in which the tuberculosis was diagnosed during the previous year. Three herds were released from quarantine. There were 1,024 pigs tested in 13 herds, 89 being reactors.

Pig specimens subjected to pathological and bacteriological examination for suspected tuberculosis numbered 110, of which the disease was confirmed in 82 (74 per cent). Attempts to culture organisms from lesions were made in only a small number of cases and these resulted in two isolations, one belonging to group III Runyon's classification and the other being *Mycobacterium scrofulaceum*.

Policy decisions were made covering the action to be taken following the diagnosis in pigs of Battey, avian and bovine types of tuberculosis. No control measures are to be undertaken against the first type. When the tuberculosis is of the avian type, controls will be directed against the poultry, if present. In the absence of poultry, the action taken will be determined according to the circumstances. When bovine type tuberculosis is diagnosed, cattle if present will be tested. If there are no cattle, the disease will be controlled by depopulation, disinfection and spelling or by depopulation with immediate restocking followed by repeated tuberculin testing.

Tuberculosis (Poultry)

Tuberculosis was detected in seventeen flocks which were placed in quarantine. Control was by sanitation. Quarantine was also maintained on a further twenty-four flocks found infected before the start of the year. Eighteen flocks were released from quarantine after the disease was considered to have been eradicated. All outbreaks except two were in the enzootic area in the southwest of the State.

The tuberculin test is not routinely employed for control purposes but 138 birds were tested, 34 being positive.

Brucellosis (Cattle)

The official control programme based on the compulsory vaccination of female calves was continued. The scheme provides for the vaccination of all calves within protected areas as gazetted for the control of tuberculosis. In addition, there is one protected area on the North Coast specifically for brucellosis. Vaccination is by approved private veterinary practitioners at Government expense, but where practitioners are unavailable, vaccinations are undertaken by official veterinarians. Outside the protected areas, vaccination is similarly undertaken in herds found to be infected. The properties concerned are constituted as quarantined areas by agreement with owners although no restrictions are applied to the introduction or removal of cattle.

The vaccine normally used is strain 19, the use of which is restricted to calves between 3 and 9 months of age, except that with the permission of the district veterinary officer for the district concerned, either strain 19 or strain 45/20 vaccines can be used on older stock including adults.

Within protected areas, 133,255 calves were vaccinated in 6,591 dairy herds and 314,984 calves in 11,288 beef herds. Outside protected areas 1,009 calves were vaccinated in 34 dairy herds and 156,720 in 3,354 beef herds. Although the number of calves vaccinated was greater than during the previous year, the estimated percentage of the calf drop vaccinated fell from 90 per cent to 81 per cent for dairy calves and from 84 per cent to 71 per cent of beef calves within protected areas. Outside protected areas, the estimated figures were 42 per cent and 17 per cent respectively, similar to the previous year.

Adults vaccinated with strain 45/20 numbered 16,847 within protected areas and 13,727 outside. The comparative figures for strain 19 vaccination of adults were 2,621 and 13,539 respectively. Payments to practising veterinarians for vaccinations totalled \$292,599.

To identify infected herds outside protected areas, large scale surveys were undertaken. These included the submission of serum samples from cattle suspected of being infected, from randomly selected cattle and from cattle being slaughtered at abattoirs. Milk ring tests were also performed at milk depots and factories. In the field survey, serum samples were tested by the agglutination test from 4,875 dairy cattle and 54,555 beef animals. This led to 249 dairy herds and 672 beef herds being classed as infected, representing 49 per cent of surveyed dairy herds and 26 per cent of surveyed beef herds.

Serum samples from abattoirs tested by the serum agglutination test or Rose Bengal Plate Test numbered 248 from dairy cattle and 35,191 from beef animals. These tests led to the recognition of 16 infected dairy herds and 1,013 infected beef herds. A further 6,705 dairy herds were surveyed by 18,395 milk ring tests, which indicated 53 per cent of the herds surveyed to be infected. The total number of infected herds discovered during the year was 2,949 dairy herds and 1,440 beef herds.

The complement fixation test was used on sera positive to other tests to distinguish between antibodies due to infection and strain 19 vaccination. The number of samples tested in this way was 26,127 of which 9,163 were positive.

The establishment by an abattoir of beef exports to West Germany required the testing of all cattle involved—about 5,000. A programme giving serum agglutination results within 24 hours of slaughter was established.

Ninety-four isolates of *Brucella abortus* were bio-typed at the World Health Organization Reference Laboratory, Commonwealth Serum Laboratories, Melbourne. Of these, seventy-three were bio-typed one, six were bio-typed two, twelve were non-viable while three had not been typed at the end of the year. One of those classed as bio-type one was an erythritol tolerant strain 19 organism isolated from a heifer that had been vaccinated while pregnant.

A regulation was gazetted permitting the use of strain 45/20 vaccine on bulls, with the approval of the district veterinary officer for the area concerned. Strain 19 remained prohibited for male animals.

The brucellosis-free herd scheme was maintained, four herds being accredited. A decision was made to allow strain 19 vaccine to be used on calves in accredited herds.

Brucellosis (Pigs)

No cases of brucellosis were diagnosed in pigs. The brucellosis-free herd scheme was maintained, 44 herds being accredited. Pigs tested in accredited herds numbered 3,692 and in miscellaneous testing 131. There were a small number of non-specific reactions.

Anthrax

There were sixteen outbreaks, comparable to the eighteen outbreaks in 1970-1 and the sixteen the year before but significantly less than the thirty-one outbreaks in 1968-9. All were in the recognised "anthrax belt" in the west of the State. Particulars of outbreaks and deaths are given in the accompanying table.

Anthrax outbreaks

District	No. outbreaks	No. stock quarantined				No. of deaths			
		Cattle	Sheep	Pigs	Horses	Cattle	Sheep	Pigs	Horses
Far West ..	1	..	2,842	..	..	..	40	..	..
South ..	2	380	210	14	3	2	..	..	..
South West ..	9	1,167	95	..	2	26	..	..	..
West ..	4	137	7,440	238	2	15	156	14	..
Total ..	16	1,684	12,587	252	7	43	196	14	..

Stock vaccinated during the year totalled 82,274 on 159 properties. The number vaccinated was less than in the two previous years when 128,892 and 225,529 head of stock respectively were vaccinated.

Following an extensive outbreak of the disease in Victoria, a number of cartons of pet food, believed to contain meat from stock from the affected properties, were seized. The policy of imposing quarantine during the summer months on stock routes and reserves on which anthrax had occurred during the preceding 5 years was again implemented. The same ten routes and reserves quarantined last year were again quarantined. Their use was restricted to stock vaccinated against anthrax or being transported by motor vehicle.

Pleuropneumonia contagiosa (PPC)

This disease did not occur. One positive reaction to the complement fixation test for the disease was recorded in a group of cattle being tested before export but retesting confirmed that the particular animal was not infected.

Because the disease has been almost eradicated from Australia, the Casino-Port Macquarie and the South Eastern Pleuropneumonia Protected Areas into which the entry of cattle had been restricted, were revoked.

Trichomoniasis (Cattle)

This disease was not diagnosed but a dairy herd placed in quarantine during the previous year on account of infection with *Trichomonas foetus* was released after infection was considered to have been eliminated.

External Parasites (Sheep)

The number of properties quarantined on account of the presence of sheep lice (*Damalinia ovis*) was 943, similar to last year's figure of 901. The number of sheep quarantined was 1,619,006. Because of infestation with sheep keds (*Melophagus ovinus*), 18,724 sheep were quarantined on 28 properties and 8 properties with 6,610 sheep were quarantined for both lice and keds.

Lice occurred in all eleven administrative districts except the northeast where there are few sheep. Ked infestations were confined to the tablelands.

Footrot

At the beginning of the year, twenty properties in the New England Protected Area were quarantined because of the presence of footrot caused by *Fusiformis nodosus*. During the year a further eight were quarantined following detection of new outbreaks while twenty-three holdings were released from quarantine after the disease was considered to be eliminated. The infection was successfully overcome by treatment alone on six holdings, by treatment and slaughter of obstinate cases on eleven and by the sending of all infected and in-contact sheep for slaughter from six. All five flocks in quarantine at the end of the year had been in quarantine for the full year.

Elsewhere, footrot was not a major problem except in the southern part of the State during late spring and early summer, when a number of outbreaks occurred. Two commercially manufactured vaccines became available on veterinary prescription but were not registered for unrestricted sale. Two outbreaks of suspected *Fusiformis nodosus* infection occurred in cattle.

A regulation was introduced prohibiting the use of a footrot vaccine that had not been approved by the Chief, Division of Animal Industry. A further regulation introduced prohibited the use of footrot vaccines in protected areas, except with the approval of the district veterinary officer for the district concerned. No approval was given during the year for the use of the vaccine in the New England Protected Area, the only existing protected area against footrot.

Johne's Disease

Seven clinical cases of Johne's disease were diagnosed in cattle and the affected animals destroyed. All were on the Far South Coast, four being on a property which has a history of recurring cases of the disease extending back for 26 years. A further case was in an animal purchased from this property. The remaining two cases were in a herd which had purchased cattle from a further property where the disease had occurred. The disease is controlled by the destruction of affected cattle, compensation being paid to the owners concerned.

Salmonellosis

Salmonellosis occurred widely throughout the State affecting all species of commercial livestock but particularly calves and pigs. Many of the outbreaks in calves occurred in intensive rearing establishments. The incidence of the disease in sheep was lower than in recent years due to greater recognition of the importance of stress in predisposing to the disease by the management of abattoirs, where most outbreaks have taken place.

Predominating species were *Salmonella typhimurium*, *S. dublin* and *S. bovis-morbificans* in cattle, *S. cholerae-suis* and *S. typhimurium* in pigs, *S. typhimurium* and *S. pullorum* in poultry and *S. typhimurium* in sheep.

Pullorum Disease

The control of pullorum disease is being maintained at two levels. A voluntary accredited flock scheme provides for class 1 flocks (free of infection) and class 2 (incidence of reactors up to 0.5 per cent). Compulsory testing under the Stock Diseases Act applies to all other flocks from which chickens under 3 weeks of age or hatching eggs are sold. Testing is applied to maintain a reactor rate below 0.5 per cent.

The rapid whole blood stained antigen agglutination test is the field test employed. To confirm infection where the presence of reactors is likely to affect the status of a flock, the serum tube agglutination test and if necessary cultural work is carried out on the reactors.

The number of birds tested increased from 824,600 in the previous year to 927,396. Flocks in the accredited flock scheme decreased from 68 the previous year to 61 while reactors dropped from 0.03 per cent to 0.01 per cent. Flocks under compulsory test decreased in number from 34 during the previous year to 23. The reactor level was 0.3 per cent, compared with 0.41 per cent in 1970-1. The numbers of flocks and birds tested reflected the trend to fewer but larger flocks.

A high incidence of doubtful reactors was sometimes associated with *Salmonella pullorum* infection but was generally due to a degree of non-specificity in the antigen and infection with other salmonellae, particularly *Salmonella typhimurium*.

Exotic Diseases

As part of a continuing programme to provide veterinary officers with experience in exotic diseases, two senior veterinary officers visited United States of America and observed exotic disease eradication programmes in operation. One observed measures against Venezuelan equine encephalomyelitis while the other studied the eradication programme for an outbreak of virulent Newcastle disease in poultry.

A comprehensive plan to be a model for all States for the eradication of swine fever and African swine fever was drawn up and submitted to the Exotic Diseases Subcommittee of Commonwealth and States Veterinary Committee.

The Valuer-General neared the end of a project to draw shire maps showing external boundaries of all rural holdings. The project was expanded to include larger urban areas and cities and should be completed next year. The maps proved invaluable in dealing with simulated outbreaks of foot and mouth disease during exercises included in the exotic diseases training courses. They are also being used in district offices in current disease control programmes.

Testing of Vaccines

Forty-nine clostridial vaccines and six anthrax vaccines were examined for safety and bacterial contamination. Some trouble was experienced with the safety testing of clostridial vaccines containing selenium because of the low LD50 of selenium for mice and guinea pigs. A number of clostridial vaccines produced ulceration at the site of injection in guinea pigs.

One manufacturer continued to submit anthrax vaccines in rigid plastic or blow-moulded plastic containers although repeated spore counts on vaccines in these containers are too low for registration requirements.

ANIMAL HEALTH DIAGNOSTIC SERVICES

Mastitis

The importance of mastitis as an economical herd problem increased significantly with the adoption by the Dairy Industry Authority of the practice of rejecting milk which produced a yellow stain on filter discs, found to be caused by subclinical mastitis. Observations indicated that 15 per cent or more of udder quarters in a herd positive to the rapid mastitis test could lead to milk rejection on this account.

Laboratory examination was undertaken of 2,699 milk samples from 96 herds in which the disease occurred. *Staphylococcus aureus* was present in 21·2 per cent of samples, *Staphylococcus epidermitis* in 19·4 per cent, *Streptococcus agalactiae* in 12·8 per cent, *Streptococcus dysgalactiae* in 5·0 per cent and *Streptococcus uberis* in 1·4 per cent. Of the *Staph. aureus* isolates, 41·6 per cent were resistant to penicillin and 7·5 per cent to streptomycin. There was a significant increase over the previous year's figure for the number of samples positive for *Strep. dysgalactiae*. *Strep. agalactiae* isolations were relatively higher in milk samples from routine herd samplings than in those from clinical cases of mastitis.

Milk samples examined from herds not known to be infected numbered 2,997. Again *Staph. aureus* was the predominating organism.

Leptospirosis

Leptospira hardjo continued to cause clinical symptoms of abnormal milk and loss of production over a wide area of the State, though the number of cases in individual herds was lower than the previous year. The infection also caused a large number of abortions. Observations demonstrated a comparatively rapid fall in serum titres after infection—from high to low levels within 3 months.

Surveys were undertaken to determine the incidence of *L. hardjo* antibodies in sheep and feral pigs. Titres of 100 or more were found in 19·6 per cent of 505 sheep sera collected on 84 properties. Similar antibody levels were found in only 5 of 211 feral pig serum samples.

Leptospira pomona infection was manifest in cattle principally by widespread low levels of abortion. To a lesser extent it was the cause of symptoms and mortality in calves, the highest incidence being a 42 per cent morbidity in a group of calves held in water logged yards.

The disease caused a high incidence of abortion in pigs, the principal pathogen being *L. pomona* though some cases were caused by *L. tarrasovi*.

Cattle serum samples tested numbered 14,163 of which 1,340 were positive and 2,076 doubtful. Pig sera numbered 1,469 of which 179 were positive and 77 doubtful.

Swine Erysipelas

Erysipelothrix insidiosa was isolated from sixteen outbreaks involving mortality. No isolations were made from cases of abortion or arthritis. However, on the grounds of serology, the infection was incriminated as a cause of abortion on thirty-eight occasions, septicaemia six times and arthritis three times. Nevertheless, circumstantial evidence indicated that erysipeloid arthritis is widespread and is the cause of joint lesions that have resulted in heavy condemnations at abattoirs.

Vaccination was employed in many herds but its role in controlling the arthritic form appeared uncertain.

Mineral Deficiency

During the autumn, clinical evidence of copper deficiency was widespread in cattle on poor coastal soils, being confirmed by the findings of low liver and blood copper levels. Symptoms were diarrhoea, faded coats, loss of condition, distress on exercise and low conception rates. Many of the paddocks involved, contained improved pastures top-dressed with molybdenised superphosphate. High blood molybdenum levels were found in affected cattle.

The build up in cattle numbers brought to light greater evidence of phosphorus deficiency in the western part of the State than has been previously encountered, cattle being affected over a large part of this area.

Cysticercosis and Echinococcosis

Specimens of suspected *Cysticercus bovis* lesions detected at abattoirs and submitted for laboratory examination numbered 118. Of these 23 were diagnosed as *C. bovis* based on the identification of recognizable cestode material. Most of the other specimens were probably degenerated cysticerci but positive diagnosis was not possible.

Wherever possible, the owners of stock, in the carcasses of which hydatid cysts were detected at abattoirs, were contacted. Examinations of dogs on the properties concerned were then made and appropriate advice tendered to the owners. Infected bovine carcasses were traced by their tail tags but the tracing of sheep was almost impossible.

Laboratory Examination of Specimens

The volume of specimens submitted to the Veterinary Research Station, Glenfield and the District Veterinary Laboratories, Armidale and Wollongbar increased markedly for the third consecutive year, 16,862 specimens being received by the three laboratories compared with 13,713 and 11,637 for the two previous years. The increase was accounted for by an additional 3,040 cattle specimens brought about by expansion of brucellosis survey testing as part of the campaign against this disease.

Particulars of specimens received are shown in the following tables:

Number of consignments of specimens received at the three laboratories

Class of specimens	Glenfield	Armidale	Wollongbar	Total
Cattle	8,032	2,078	1,830	11,940
Sheep	1,282	243	..	1,525
Poultry	645	132	14	791
Pigs	1,007	307	217	1,531
Horses	140	..	..	140
Other species	417	83	76	576
Plants	65	..	..	65
Miscellaneous	255	26	13	294
Totals	11,843	2,869	2,150	16,862

Sources of diagnostic material

Source	Glenfield	Armidale	Wollongbar	Total
Departmental officers	4,838	728	706	6,272
Veterinary inspectors	2,417	772	475	3,664
Veterinary practitioners	4,318	1,199	898	6,415
Others	270	170	71	511
Total	11,843	2,869	2,150	16,862

Toxic Algae

During early summer, a gross infestation of *Anabaena circinalis* was detected in the Burrunjuck Dam. A very potent toxin was demonstrated in water samples, intraperitoneal injection of 0.25 ml either unboiled or boiled for 5 minutes causing the death of mice within 5 to 20 minutes. The danger passed within a month, no toxicity being demonstrated in samples at the end of this period. Warnings were issued to land owners whose country adjoined the dam not to allow stock access to the water. There were no reports of stock losses.

Pasteurellosis

The existence of *Pasteurella anatipestifer* was confirmed following a 16 per cent mortality involving birds 8 to 10 weeks of age in a duck raising establishment. Symptoms were diarrhoea, weakness, prostration, and death. The most prominent lesions were fibrinous pericarditis and perihepatitis. Cultures of the organism were submitted to the Houghton Poultry Research Station, United Kingdom where the organism was shown to agglutinate with *P. anatipestifer* type A anti-sera, the most common and most virulent type present in that country.

CATTLE TICK AND TICK FEVER CONTROL

Control of cattle ticks (*Boophilus microplus*) within the infested area in the northeast of the State is exercised by the Board of Tick Control under the jurisdiction of the Department of Agriculture. The area embraces a number of quarantine areas from which and within which the movement of stock is controlled.

The main areas are those east of the Richmond Range comprising a mixed dairy and beef cattle population, those west of the Richmond Range containing mainly beef cattle, the Grafton-Copmanhurst Areas of mixed cattle types which are very lightly tick infested, the Boonoo Boonoo-Cullendore Areas of mainly beef cattle in which no cattle ticks have been detected for 2 years and several areas of mixed cattle gazetted during the year after the detection of cattle ticks.

Dips in operation numbered 1,431 of which 712 were charged with ethion, 578 with dioxathion, 66 with dursban, 56 with chlorphenamidine mixtures, 14 with ethyl bromophos, 3 with diazinon, and 2 with carbaryl. Total individual dippings were cattle—5,351,980 and horses—556.

Areas east of the Richmond Range.—All stock except those in the Rappville section received six routine dippings at 21-day intervals between spring and summer. Because of the favourable tick situation in the Rappville section, stock therein were subject to only four routine dippings.

The number of cattle dipped on each occasion was approximately 500,000. Twenty-nine infestations were detected compared to thirty-two in 1970-1 and twenty in 1969-70.

Areas west of the Richmond Range.—Four routine dippings were undertaken during the late summer and autumn. Approximately 140,000 head of cattle were treated on each occasion. Seven infestations were detected, compared with twelve in 1970-1 and thirty-one in 1969-70.

Policy for infested holdings.—The policy requiring stock on infested holdings to receive six dippings at 21-day intervals with the proviso that no cattle ticks be found when stock are examined at the last three dippings, was again implemented. After the treatments, stock were examined twice at 21-day intervals. However, the application of this policy became limited as greater numbers of infestations proved to involve strains of ticks resistant to the common acaricides. These required the special control measures listed in the next section.

Multi-resistant ticks.—Resistance was either confirmed or suspected in the ticks infesting thirty-five of the thirty-nine herds on which cattle ticks were found. On five of the properties, the ticks appeared to be of the Ridgeland resistant strain and on the remaining thirty, of the Biarra resistant strain. Detection of the resistant ticks made necessary the gazettal of twelve special areas involving twenty-nine infested properties with some 4,331 head of cattle. The remaining six properties were associated with special areas created during the previous year.

The policy within the special areas required the treatment of stock on infested properties every 14 days for 10 months after detection of the last tick. Dursban was used for Biarra resistant ticks and ethion for those showing Ridgeland resistance. Stock on adjoining properties were examined at 21-day intervals for 10 months. Restrictions were placed on the movement of stock from the areas.

In several of the outbreaks, spread of ticks by stock movement and directly to adjoining properties had taken place before detection. The finding of resistant ticks in areas where such ticks had not been previously detected, was a matter of concern. It could indicate a spread of ticks by lightly infested cattle, dipped for movement in an acaricide unsuitable for resistant ticks.

Grafton-Copmanhurst Areas.—The policy of examining of cattle on as many properties as possible was again implemented. The number of cattle examined was 72,557, a single tick being found on a beast in each of three herds. Examinations of cattle were continued at the Grafton abattoir but no cattle ticks were detected.

Boonoo Boonoo-Cullendore Areas.—Cattle were subject to examination, 25,530 head being examined. No cattle ticks were detected.

Newly infested areas.—Eradication measures were instituted following the detection in late 1970-1 of cattle ticks in what was previously regarded as uninfested country. Quarantine areas were established at Turner's Flat near Kempsey where cattle ticks were found in three herds and on a further property in the same area where ticks had been found.

An additional fifty-one properties in the area and twenty-one in other parts of the State were placed in quarantine on account of possible infestation arising from stock movements, the movements of grass seed harvestors or the purchase of grass seed from infested areas. Restrictions were later removed from all except two properties near Cessnock. The latter were leased by the Department of Agriculture and emptied of stock which had been given three treatments before removal.

Three dips were constructed at Turner's Flat and a programme of dipping every 14 days for 12 months, instituted for approximately 2,400 head.

A property near Sydney was quarantined following the illegal introduction of a goat from a tick quarantine area. No cattle ticks were found.

Currumbin Valley, Queensland.—To reduce the possibility of ticks being introduced into New South Wales from the adjoining part of Queensland, a programme of dippings at 21-day intervals was undertaken on a voluntary basis in the Currumbin Valley; fifty holdings came under control involving 2,427 head of cattle.

Inspection of stock at abattoirs.—Examinations were continued on cattle arriving at the major abattoirs within tick quarantine areas and on certain abattoirs in clean country. Within the quarantine areas, the inspections led to the detection of a Ridgeland resistant type infestation. No cattle ticks were found at abattoirs in clean country.

Examinations in clean country.—Due to a staff shortage, mobile inspection teams were confined to inspecting cattle on properties in the Kempsey area. These examinations did not detect any cattle ticks.

Tick fever.—Two outbreaks were diagnosed, both on properties within tick quarantine areas. One was caused by *Babesia argentina* but the cause of the other was not determined. Arising from these outbreaks, 2,481 head of cattle on twenty-two properties were tested, resulting in the detection of a carrier of *Babesia bigemia*.

Two head of cattle on a recently quarantined property at Turner's Flat were found by transmission to carry *Anaplasma marginale* supporting the view that the infestation in this area probably originated from Queensland, as infection with this protozoon is extremely rare in New South Wales.

Claims for compensation.—Compensation claims involving \$12,000 were paid for the loss of 267 head of stock by death or injury associated with dipping.

Constructional work.—Approximately 13 miles of new fencing surrounding quarantine areas was erected and 29 miles of existing fence repaired; 6 dips were constructed and repairs were undertaken to 394 dips and 59 dip yards.

Delivery was taken of four cottages and two camp units of panel modular type for staff accommodation. Twelve auto-tent units, two camp units and two road offices were also fabricated and erected in the Kempsey area. One new cottage, seven camp units, four garages and two portable road offices were erected within the established quarantine areas. Twelve sleeping units were procured for fencing, dip, and building gangs. Septic units were installed in five cottages and repairs and renovations made to fourteen cottages, nine camp units and nine tent units. Electrical connections were made to two cottages, two road offices and two camp units.

DAIRY INDUSTRY
Dairy Industry Act

Dairy factories.—Because of reduced dairyfarm production, seven factories ceased operations while three amalgamations took place. Ninety-seven factories remained operative. All factories were inspected. Orders requiring minor repairs to plant and equipment were issued to some managements but major improvements, where needed, were effected voluntarily.

Dairy stores.—The registration of twenty-nine stores was cancelled because they had ceased operations or the premises were unsatisfactory. Thirty new stores were registered bringing the total number of stores registered to 192.

Examinations.—Students at the School of Dairy Technology, Hawkesbury Agricultural College and factory operatives were examined for Certificates of Competency in buttermaking, cheesemaking, cream and milk grading, and milk and cream testing.

The number of certificates issued is shown in the accompanying table.

Certificates of competency issued under Dairy Industry Act

Subject	Certificates issued
Milk grading—Factory certificate	33
—Grader/driver certificates	26
Cream grading certificate	28
Milk testing certificate	48
Cream testing certificate	45
Cheesemaking certificate	17
Buttermaking certificate	23
Total	220

New Act.—Work was completed on the draft of a new Act and partly completed on new regulations.

Detergents and Sanitisers Act

A determination is being made as whether this Act might be incorporated within the proposed Pest Destroyers Act. An agreement was drawn up to implement an advisory scheme for detergent testing.

Milking Machine Act

Information was collated for proposed legislation controlling the issue of milking machine testing certificates.

Code of Practice for Dairy Buildings

The Department of Primary Industry in conjunction with the Victorian Department of Agriculture (the collating body) drew up a code of practice for factories manufacturing dairy produce for export to be implemented throughout Australia during 1972–3. Managements of factories under construction or proposed in New South Wales, were requested to comply with this code as far as possible, irrespective of whether or not their produce was for export.

Herd Recording

Official section.—The pattern of expansion of the scheme and increased production of recorded cows, evident in recent years, continued. The scheme embraced 352 herds and 12,731 cows, of which 11,573 completed normal records. These numbers exceed the 1969–70 peak by 22 herds and 1,442 cows.

Compared with the previous year, average production increased by 169 lb milk and 4 lb butterfat, the 11,573 cows averaging 9,286 lb milk and 373 lb butterfat. The 5,211 Friesian cows being recorded averaged 11,037 lb milk and 401 lb butterfat.

Group Section.—The number of cows recorded was 90,981 of which 80,815 completed lactations of from 4 to 10 months and averaged 6,666 lb milk, 4.12 per cent butterfat and 274 lb butterfat per cow. This was second only to the record production achieved the previous year when 79,522 cows averaged 6,746 lb milk, 4.18 per cent butterfat and 282 lb butterfat per cow.

The lactations of 3,629 cows were only of 1 to 3 months duration while a further 6,537 cows were recorded only for part of their lactations. These latter either came into the herds late in lactation, or were removed from the herds before completing lactation for reasons other than low production. Figures for cows in these two categories are excluded from statistical tables.

The number of herds recorded was 1,481. Although this figure represents twenty-seven fewer herds than in the previous year, herds recorded rose from 19 to 22 per cent because of the decline in the total number of herds. The average number of cows per herd completing lactation was sixty-one. The 1970–1 figure was sixty.

Production for the highest producing districts is shown in the following table:

District averages for top three districts

District	Number of cows	Milk production lb	Butterfat %	Butterfat lb
Muswellbrook	8,060	8,539	3.84	328
Nowra	11,121	8,196	3.84	315
Deniliquin	10,461	7,213	4.36	314

The next table shows the different breeds as a percentage of total cows recorded since 1960–1. The increase in the Friesian breed is apparent.

Breed representation in recorded herds

Breed	1960–1 %	1964–5 %	1968–9 %	1970–1 %
Australian Illawarra Shorthorn ..	20	17	13	11
Ayrshire	3	3	3	3
Friesian	13	25	33	40
Guernsey	6	7	9	9
Jersey	57	47	41	36
Others	1	1	1	1

Demand for service.—The fall-off in demand, previously evident, was arrested this year. An increase of 22 herds in the Official Section and a decrease of 27 herds in the Group Section left a net decrease of 5 herds compared with 140 herds last year. This encouraging result occurred despite a fall of almost 1,000 (1.1 per cent) in the number of registered dairies.

In areas not subject to Dairy Industry Authority milk quotas, it was obvious that once the farmer committed himself to install a bulk tank and bring his dairy to Dairy Industry Authority standards, his interest in herd improvement revived. This was particularly evident on the Far North and Far South Coasts. In the quota milk areas of the Queensland Milk Board, the demand for additional service increased.

Equipment changes.—All units are now equipped with milk meters in place of recording buckets. The meters require greater servicing than the buckets, and must be returned to the manufacturer when repairs are needed. Thus, the cost and inconvenience is greater than was incurred with buckets.

Processing changes.—Use of optical character reading (OCR) equipment to replace punch card input for Official Section subperiod data for the computer, and a change from lactation to subperiod computer processing of the Group Section using an OCR machine was investigated.

The facility is available from the Railways Department and would enable use of a processing technique at lower cost than is at present incurred. It would also relieve the recorder of one of his most onerous chores, that of calculating fat yields.

Quality Control

Grading services.—Dairy produce graders made regular examinations of butter and cheese received at Sydney, Newcastle, Canberra, and Wagga for distribution and storage before sale on the local market. Trained grading officers were also stationed at Newcastle and Lismore to grade all district butter for sale or storage.

Details of the grading were supplied to distribution agents, factory managers, and district dairy officers for quality control and extension work. Statistics of the butter graded were used for the order of merit of the Department of Agriculture and the continuous grading competition of the Royal Agricultural Society.

At the request of agents, the quality of 56 million lb of butter and 9 million lb of cheese introduced from other States was also checked before distribution. Other dairy products were similarly examined. Surveys were regularly conducted to determine butter quality at consumer level. Results were conveyed to the relevant industry organisations.

Biological quality in N.S.W.—Biological examination of bulk butter consigned from country factories to grading floors at Sydney, Granville, Newcastle, and Blacktown was carried out during the main producing months from September to April. Samples totalling 1,089 were examined for five different microbiological counts. The results, together with brief comments on possible causes of contamination and recommendations for improvement, were sent to district dairy officers and factory managers.

Quality this year improved, and the percentage of samples satisfactory on all counts was the highest since the total count standard was lowered in 1968. Testing for *Escherichia coli* type I and coagulase-positive staphylococci was regularly carried out. This year, more samples from interstate than New South Wales factories were examined.

A survey of the quality of retail butter in country areas was carried out and involved seventy-four samples. The percentage of satisfactory samples declined compared to the previous year.

Several surveys of butter processing plants were carried out. Samples to be microbiologically analysed were taken from each stage of the processing, to indicate areas where improvement could be made in the cleaning and sanitizing of equipment, and in the hygiene of factory personnel.

Bacteriological examination of cheese produced in New South Wales continued. Samples taken from each factory once a month were examined for *Escherichia coli* and *Staphylococcus* spp contamination. Testing for *E. coli* type I and coagulase-positive staphylococci was routinely introduced. Overall, cheese quality remained about the same as last year, but staphylococcal counts decreased while those of coliform organisms increased. A major contributing factor to this situation was the regular sampling of cheese from small, fancy cheese manufacturers. Higher biological advisory standards were introduced.

Several investigations of cheese quality problems were made at factories. Examinations of milk, whey, rennet, salt, and water samples were carried out to determine possible sources of contamination.

Chemical quality.—Because of differences between workers scoring extraneous matter tests, meetings were arranged between officers of the Commonwealth Customs Department Laboratory and the Department of Agriculture to achieve uniformity in interpretation. As a consequence, survey results for extraneous matter were significantly better in the second half of the year.

Data such as fat in dry matter, water content and pH of individual varieties obtained from the survey influenced submissions to other organizations in regard to prevailing standards for cheese composition and controls on imported cheese.

Starter Cultures

Starter cultures for the manufacture of cheese, yoghurt, and other cultured milk products were supplied to dairy factories in New South Wales. The number provided was 2,283, mostly in freeze-dried form. Enquiries for cultures to make yoghurt and cheese at home became more frequent.

Cultures for use in testing for the presence of antibiotics and other inhibitory substances in milk products were also supplied to factories in New South Wales.

ANIMAL QUARANTINE

Certain sections of the Quarantine Act relating to the importation of animals and animal products and the export of animals are administered on behalf of the Commonwealth Government.

Animal imports.—A total prohibition remained on the importation of sheep and goats but the ban on the introduction of dogs and cats from the United Kingdom was lifted. Because of limited quarantine accommodation available it was necessary to introduce a permit system to ensure no overloading of facilities at any port.

Four attempts to smuggle prohibited imports were detected. These involved two dogs, two cats, two birds, and nineteen turtles. An additional four dogs, four birds, and twenty insect pupae arrived by air illegally either having been overcarried from another port or were declared before or on arrival. On three occasions, prohibited species such as anemone, newts, and tuberfix worms were found in regular fish shipments.

Passengers' baggage.—Co-operation with officers of the Commonwealth Department of Customs and Excise continued in searching for illegal goods in the baggage of passengers arriving by sea and air. Seizures of the main items from this source included 4,769 lb meat, 2,506 lb cheese, 2,093 lb trahana, and 1,301 eggs. Each of these seizures was greater than during the previous year. Possession was also taken of 250 drums, 164 used egg cartons, 439 rawhide items, and 56 afghan coats (raw or only partially tanned). These numbers were again greater than in 1970-1. Two drums and 31 lb meat were also confiscated from members of the defence forces returning from overseas.

Disinfection of footwear and work clothes brought by incoming air passengers, who had been associated with rural industries in countries where foot and mouth disease exists, continued. Some 1,388 pairs of shoes were disinfected and 2 clothing articles detained for laundering from 848 passengers, a 50 per cent reduction on the previous year's figures.

Parcels post.—Liaison was maintained with Customs officers to ensure the examination of all suspect parcels. Misleading and false declarations regarding parcel contents increased the difficulty of discovering prohibited materials. Many items of prohibited food of animal origin were confiscated, the more significant being 1,758 lb meat, 127 lb cheese, 219 lb noodles, and 94 eggs. With the exception of the amount of cheese which is slightly below that seized last year, all the others showed a 100 per cent increase. In addition, 48 drums, 80 rawhide articles, 15 used egg cartons, and 6 animal skin coats were detained.

Ships' pets.—Supervision of pets on overseas vessels while in port remained strict. On a number of occasions, ships officers were instructed to tighten precautions against possible escape. During the year, 311 masters bonds were taken out in relation to 72 dogs, 35 cats, 743 birds, 9 monkeys, 1 rabbit, 1 squirrel, 1 guinea pig, 20 turtles, and 5,089 fish. No bonds were estreated.

A dog was destroyed because of a master's refusal to sign a bond. A monkey, suspected of having escaped from an overseas vessel in Sydney was found by children who handed it to the police. It was destroyed.

Export of animals.—Control over the export of animals involved inspection, issue of health certificates and sometimes supervision of treatment as required by an importing country. Health certificates issued totalled 1,876.

MEAT INSPECTION

Ante-mortem inspection of cattle was carried out at Homebush Saleyards on 3 days weekly and once weekly of pigs. All cattle were inspected on receipt at Homebush Abattoir. Animals were ante-mortem inspected on the day of slaughter at some works. Animals submitted for emergency slaughter were examined at all abattoirs before being killed. In some areas where facilities are provided, this service was extended to saleyards and private properties.

Post-mortem inspection was carried out at the time of slaughter at twenty-three abattoirs and two slaughterhouses. Post-mortem inspection of horses was carried out at one pet food knacker.

Meat introduced into the Metropolitan Abattoir Area was re-inspected and supervision of meat handling at meat markets in the metropolitan area was carried out.

Inspections were regularly made of meat-carrying vehicles and smallgoods factories. Inspections of retail butcher shops were made periodically.

Meat inspection.—Carcasses and viscera of 1,206,550 cattle, 199,188 calves, 850,464 pigs, and 12,695,666 sheep were inspected post-mortem. Particulars of condemnations are set out in the following table:

Cause	Cattle		Pigs		Sheep	
	Total	Partial	Total	Partial	Total	Partial
Abscess	4	1,491	2	7,526	7	3
Actinomycosis } ..	52	19,724	..	..	..	..
Actinobacillosis }						
Arthritis	177	3,167	3,314	4,776	7,378	13,544
Cancer	1,390	11,271	44	..	2,239	17
Fever	234	..	193	..	6,451	..
Hydatids	109	..	73	..	2,452	..
Jaundice	12	..	34	..	2,600	..
Sarcosporidiosis ..	2	..	..	..	4,444	..
Septicaemia	142	..	128	..	900	..
Bruising and injury ..	308	898	32	430	925	2,181
Contamination	16	4,480	7	573	557	4,753
Emaciation	381	..	38	..	21,888	..
Caseous lymphadenitis ..	..	..	..	..	49,960	20,371
Cysticercus ovis	..	..	..	..	2,312	..
Pleurisy	..	..	..	..	12	4,706
Other abnormalities ..	967	1,421	973	453	1,171	136
Totals	3,794	42,452	4,838	13,758	103,296	45,711

The following table shows the quantity of meat re-inspected after introduction into the Sydney metropolitan area from country areas of N.S.W. and other states.

Meat	From other States	From within N.S.W.
Beef carcasses (no.)	67,269	460,951
Beef pieces (lb)	6,514,220	7,292,005
Veal carcasses (no.)	80,772	104,962
Veal pieces (lb)	533,762	43,739
Pork carcasses (no.)	91,566	431,410
Pork pieces (lb)	9,542,509	508,134
Bacon (lb)	2,602,188	1,383,747
Mutton carcasses (no.)	99,250	4,767,420
Mutton pieces (lb)	1,718,749	2,752,590
Buffalo meat (lb)	4,669	...
Goat carcasses (no.)	...	2,129
Sundries (lb)	472,316	8,358,317

The following table shows the amount of introduced meat condemned:

Species	Whole carcasses No.	Part carcasses No.	Meat pieces lb
Cattle	3	17	105,088
Calves	1	2	..
Pigs	..	31	4,183
Sheep	84	129	11,046
Associated smallgoods	..	..	22,917

Causes of condemnation were spoilage, contamination, bruising, haemorrhages, and arthritis.

NOXIOUS ANIMALS AND INSECTS

Rabbits

Rabbit control is administered by the Department of Agriculture but organized by Pastures Protection Boards. The level of control in different districts varied markedly. However, twenty-nine boards reported that over 9,000 properties occupying more than 15,000,000 acres were free of rabbits.

Sodium fluoroacetate (1080) still featured predominantly in controlling rabbits. Some 459 lb of the material was supplied to boards during the year. This was less than during 1970-1 (571 lb) and 1969-70 (639 lb).

Plague Locusts

The year saw the most severe outbreak of plague locusts (*Chortoicetes terminifera*) for 17 years in the western Riverina and southern part of the Western Division. Because the outbreak had been anticipated from autumn locust activity, a large scale campaign was mounted. It involved the secondment of some 70 Department of Agriculture, pastures protection boards and Victorian Department of Agriculture field staff, in addition to the voluntary assistance and supply of equipment from at least 150 local persons working as spray teams under the direction of New South Wales field officers.

Insecticide used consisted of 48,000 lb lindane, 40,000 lb maldison, and 105,000 lb fenitrothion, the last named being applied from aircraft to flying swarms. The provision of thirty-three high frequency single sideband radio transceivers significantly improved control team mobility and aircraft communication, particularly in remote areas. Despite the severity of the outbreak, control was successful in drastically reducing locust numbers and effectively delaying adult locust migration.

PESTICIDE RESIDUES

Meat and dairy products produced in tick quarantine areas continued to be monitored for residue levels resulting from the dipping of cattle in various acaricides. Organophosphate residues in meat fat samples ranged up to 1.69 ppm for cattle dipped in dioxathion and to 2.96 ppm after dipping in ethion. Butter fat samples had residues up to 0.48 ppm and 0.45 ppm after dipping in dioxathion and ethion respectively.

A campaign was conducted to discourage the use of hexachlorobenzene (HCB) treated wheat for poultry feeding. The examination of eggs by the New South Wales Egg Marketing Board indicated the position to be satisfactory. Analyses for HCB were conducted on 129 pig fat samples randomly collected from six abattoirs located in wheat growing areas. Not one sample contained less than 0.1 ppm HCB while 51 per cent showed residues above 1.0 ppm. The maximum residue was 115.0 ppm.

To determine residue levels that might result from the use of lindane for plague locust control, sheep were grazed for periods of 3, 6, and 9 weeks on pastures immediately after spraying and also over 3 to 6 weeks commencing 3 weeks after spraying. Maximum fat concentration was 2.64 ppm of lindane at 3 weeks immediately after spraying, dropping to 0.5 ppm and 0.28 ppm at 6 and 9 weeks respectively. Deferment of grazing for 3 weeks after spraying resulted in means of 0.6 and 0.33 ppm after 6 weeks.

QUEENSLAND BORDER CONTROL

Control is exercised over the introduction of stock from Queensland owing to the presence of cattle tick (*Boophilus microplus*) in a large section of that State. Five cattle dips and one sheep dip are maintained, all charged with dursban 0.05 per cent.

The following tables show numbers of stock which moved across the border:

From Queensland to New South Wales

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	66,847	8,173	12,839	3,615	50
Goondiwindi	294,313	282,871	2,471	8,325	62
West of Mungindi	16,821	167,953	..	2,298	845
Totals	377,981	458,997	15,310	14,310	957

From New South Wales to Queensland

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	59,165	373,683	2,824	1,516	..
Goondiwindi	172,729	1,248,237	45,218	1,686	21
West of Mungindi	2,198	86,642	..	158	..
Totals	234,092	1,708,562	48,042	3,360	21

Because cattle ticks were found in part of western Queensland where this parasite does not normally occur, a proclamation was issued declaring a special area in that part of Queensland. Cattle entering New South Wales from that area were required to undergo the same treatments as cattle entering from the infested part of Queensland.

New fencing was erected to replace 240 chains of worn fencing along the Border. Because of the low level of the Macintyre River, additional fencing was also erected in certain places where this river forms the boundary between the two states. A new dip was constructed to replace one that had become unserviceable. Repairs, renovations, and improvements were effected to nineteen staff cottages, two camp units, two dip yards, one dip, and one border gate.

LEGISLATION

Cattle Compensation Act

Claims approved for payment totalled 16,580, more than double the 7,183 claims approved during 1970-1. Compensation was paid for 23,173 cattle ordered to be destroyed on account of suspected disease and 1,024 carcasses condemned during the course of meat inspection.

Particulars of the diseases on which claims were paid are set out in the following table:

Disease	Claims No.	Animals No.	Payment \$
Tuberculosis	777	1,280	131,842.85
Cancer	11,070	17,073	815,702.56
Actinomycosis	3,468	3,674	149,815.68
Actinobacillosis	1,248	2,147	57,493.11
Pleuropneumonia contagiosa	1	1*	65.60
Bovine tick fever	3	9	1,076.40
Johne's disease	9	9	852.40
Vibriosis	4	4	429.82
Totals	16,580	24,197	1,157,278.42

* Subsequently found unaffected with pleuropneumonia contagiosa.

The following table shows the number of claims disallowed and the reasons for disallowance:

Delayed notification of disease	..	..	..	..	..	..	..	468
Failure to notify disease	..	..	..	..	..	..	..	43
Non-payment of cattle compensation levy	..	..	..	..	..	..	..	14
Failure to lodge stock return	..	..	..	..	..	..	..	14
Late application for compensation	..	..	..	..	..	..	..	546

In addition, the compensation payable was reduced for 102 claims on account of delayed application.

The amount paid in compensation was more than double that of 1970-1. Standards applied to licensed export abattoirs by the Department of Primary Industry necessitated the destruction of increased numbers of cattle on properties and the trucking of many condemned animals up to several hundred miles to an abattoir at which they were acceptable.

Swine Compensation Act

Claims paid for pigs ordered to be destroyed on account of suspected disease and carcasses condemned during meat inspection were as follows:

Diseases				No. of claims	No. of pigs
Tuberculosis	..	..	..	27	124
Septicaemia	..	..	..	122	176

Because of the favourable state of the Swine Compensation Fund, action was taken to suspend the collection of stamp duty on pigs delivered for slaughter. Interest on the fund's balance remained the only source of income for the fund.

Stock (Artificial Insemination) Act

Two privately conducted subcentres were licensed during the year to supply bull semen. The policy was continued of testing bulls intended for artificial insemination centres for disease on the properties from which they are being purchased, at an admission centre external to the breeding centre and finally in an isolation centre within the artificial breeding centre. In addition annual tests were performed.

Bulls were tested for tuberculosis, brucellosis (serum agglutination test and complement fixation test) *Leptospira pomona*, *L. tarasovi*, *L. hardjo*, *L. icterohaemorrhagiae*, contagious bovine pleuropneumonia, Johne's disease, Q fever, ephemeral fever, trichomoniasis and vibriosis. The practice of test mating bulls to virgin heifers for diagnosis of the last two diseases was abandoned in favour of the collection of preputial samples for culturing for *Trichomonas foetus* and *Vibrio fetus*, and the use of the fluorescent antibody test for the latter disease.

Numbers of bull tests performed included, on-farms—124; at admission centres—62; at isolation centres—60; and annual tests—129. Twenty-two bulls were rejected as a result of on-farm tests, twenty-one because of reactions to ephemeral fever and one on account of a brucellosis reaction. One bull was rejected at an admission centre because of a positive brucellosis reaction.

Certificates of competency were issued to twenty-eight persons for the insemination of cows, to six persons for the collection, appraisal, dilution, storage, and packaging of semen and to one person for the insemination of sheep.

Stock Foods and Medicines Act

Registration was granted to 1,947 stock foods, an increase on last year's figure of 1,823. Manufacturers were required to furnish particulars of antibiotics or other feed additives which could lead to residues in carcasses or products. Analysis of 177 stock food samples showed that the composition of 72 failed to conform to the registered formulation as stated on the label. An excess or a deficiency of fat was found in 44 samples, a deficiency of protein in 17 and an excess of fibre in 11.

The Stock Medicines Board dealt with the registration of 2,030 applications of which 1,575 were re-applications and 206 were applications for new preparations. In four cases registration was refused whilst 245 applications were still under consideration at the end of the year.

The Board continued to maintain liaison with the Technical Committee on Veterinary Drugs, with the Department of Health concerning the Poisons Act and also the National Biological Standard Laboratory regarding the testing of biological products.

Poultry Processing Act

The main activity of inspectors involved the testing of carcasses during processing to assess the amount of water retained. A significant decrease in the level of water in poultry carcasses occurred following the introduction of the legislation.

Veterinary Surgeons' Act

Regulations were introduced restricting the frequency and size of advertisements by veterinarians.

Pest Destroyers Act

This legislation is dealt with in section 6.1 Regulatory and Technical Services: Plants and Plant Products.

Prosecutions

Thirty-nine successful prosecutions were undertaken under the Stock Diseases Act or its regulations. Of these, seventeen were for breaches of the regulations requiring tail tags bearing a registered number to be affixed to sale cattle, fourteen were for failure to notify the presence of sheep lice, two were for the removal of stock from properties quarantined on account of tuberculosis, and two were for the movement of pigs from a saleyard other than to an abattoir or slaughterhouse. Two veterinarians were successfully prosecuted under regulations to the same Act for allowing lay persons to vaccinate dogs against distemper while the lay persons concerned were also successfully proceeded against.

There was one successful prosecution under the Stock Foods and Medicines Act against a manufacturer for selling a stock food with a protein content appreciably lower than that stated on the label.

APICULTURE

Livestock officers (apiculture) in their capacity as apiary inspectors enforced the provisions of the Apiaries Act to prevent the spread of serious bee diseases and in particular American foul brood disease caused by *Bacillus larvae*. Twenty-one outbreaks were recorded.

Inspections of apiaries were made and appropriate certificates prepared for the export of bees, honey, and other apiary products to other states and overseas. Assistance was given to the Quarantine Section regarding imported bees.

MISCELLANEOUS SERVICES

Fleece Measurement Service

The number of commercial samples processed by the Trangie Fleece Measurement Service was 3,260 compared to 4,966 in 1970-1. The reduction was a direct result of the rural recession. However, the decrease was mostly due to less samples per stud rather than fewer studs. The number of studs availing of the service for the first time was twenty-four compared to forty the previous year.

Sheep Fertility Service

A second sheep fertility service was established at Wagga Agricultural Research Institute and commenced investigations on twenty-five properties. Trangie continued to provide the main service and for the year have carried out investigations on over thirty properties.

Margarine

Twenty-five margarine samples were subjected to the same testing for quality as butter. Four had high coliform counts and the presence of *Escherichia coli* type I was verified.

Several samples of table margarine were also examined for polyunsaturated oils. Suggestions were made with regard to labelling requirements in relation to cholesterol content.

Drought Relief

Eighteen out of the fifty-nine pastures protection districts and the Australian Capital Territory, were declared drought-stricken during portion of the year so that stockowners therein could be eligible for Government assistance in the form of freight rebates on introduced fodder or on the carriage of stock to and from agistment.

Public Watering Places

Maintenance and improvement of public watering places in the Western Division continued at a similar rate as in previous years with an expenditure of approximately \$84,000. The major travelling stock routes in this area now have public watering places strategically located every 10 or 12 miles.

Travelling Stock Reserves

Reserves or parts of reserves approved for withdrawal from the control of pastures protection boards (with the boards consent) totalled 180. A systematic review of the situation was made in three districts. These reviews permit the boards concerned to make overall recommendations for the disposal of unwanted reserves.

Brands and Earmarks

New applications for the allotment of large stock brands totalled 1,562 while 1,328 such brands were transferred to other owners.

For sheep, earmark transfers and original applications totalled 863, colour brand transfers and new applications totalled 709 and there were three applications for the transfer of a sheep fire brand.

Swine brands allotted were 1,558, transfers 475 and licences issued 14. A total of 1,874 swine brands were cancelled.

6.3 MARKETING SERVICES AND SERVICES TO OTHER ORGANIZATIONS

MARKETING REPORTS AND RELATED SERVICES

Reporting of Prices and Supplies of Primary Produce

The Division of Marketing and Economics continued to collect and disseminate market information as required under the Marketing of Primary Products Act, 1927.

Reports covering supplies, quality and prices were provided for each of the trading days of the following wholesale markets; City Municipal Markets, Homebush livestock market and the Alexandria and Perry Park selling centres. The retail prices of certain commodities were also reported.

This information is disseminated via the daily press, periodicals, radio, and TV in addition to being made available in mimeographed form to government departments and instrumentalities, producer organizations and the public.

The Division continued to record statistics of apples and pears held in cool and controlled atmosphere storages throughout New South Wales.

Records of selected arrivals into Sydney by rail, air and ship of various primary products from interstate and intrastate sources were maintained.

Monthly reports on prices and trends in pig production throughout the State were supplied by the Division of Animal Industry to primary producer organizations, banks, and the Bureau of Agricultural Economics.

Crop and Livestock Reviews and Forecasts

Acreage estimates and production forecasts were prepared for wheat, oats, and barley; production forecasts for citrus fruits.

The regular monthly survey of *New South Wales Pastoral Conditions* and the monthly *Report on Production Trends* continued to be issued.

Cost and Income Survey of N.S.W. Dairy Industry

The Dairy Industry Authority Act, 1970 requires the Division of Marketing and Economics to conduct cost-income surveys of all sections of the dairy industry in N.S.W. A survey covering the three financial years 1967-8 to 1969-70 has been carried out and a preliminary report forwarded to the Dairy Industry Authority.

SERVICES TO OTHER DEPARTMENTS AND ORGANIZATIONS

This Department provides a significant and fairly comprehensive range of services to other departments and organizations the details of which would be too numerous to list individually. The following are an example of the range of services provided.

Division of Animal Industry

- supplied breeding stock for some pig herds maintained by other departments;
- supplied pigs for research purposes to the Children's Medical Research Foundation, University of Sydney and CSIRO;
- provided clinical and disease control services for stock on farms administered by other departments.

Division of Horticulture

- continued to assist State Treasury by assessing damage to fruit crops by hail for purposes of financial assistance to growers;
- provided advice on packaging, transportation, and marketing of fresh fruits and vegetables to the Sydney Farm Produce Market Authority;

- assisted New South Wales Water Conservation and Irrigation Commission, Lands Department, and Rural Assistance Board in relation to land use and irrigation problems and the rehabilitation of soldier settlers.

Division of Plant Industry

- carried out inspections and prepared reports in relation to seventy loan applications under the Farm Water Supplies Act, for the New South Wales Water Conservation and Irrigation Commission;
- prepared several reports on damage caused during operations of employees of other departments and instrumentalities, to assist in settlement of compensation claims;
- carried out twenty inspections under section 48 of the Mining Act on behalf of the Department of Mines to assess land classifications where applications for entry to prospect or mine had been lodged.

Biological and Chemical Research Institute

- co-operated with the Forestry Commission of New South Wales in monitoring the spread of poplar rust disease in the State;
- co-operated with the National Parks and Wildlife Service and the Fisheries Branch of the Chief Secretary's Department in environmental studies;
- provided assistance to the Police Department and the Commonwealth Police Force with chemical and fungal identification;
- provided services to various departments, local government bodies and other organizations in connection with: argentine ant eradication, plague locust, clearance of agricultural chemicals for registration, fresh fruit disinfestation, fruit fly suppression campaigns, grain pests investigations, insecticide resistance, insects of importance to public health, toxicity of insecticides, insect identification, parasite liberations, and pests' management investigations.

Biometrical Branch

- gave statistical advice to personnel of the Chief Secretary's Department, the Forestry Commission of New South Wales, the Department of Labour and Industry and the Department of Health.

Royal Botanic Gardens and National Herbarium

- assisted the Police Department and the Department of Customs and Excise with information and identifications concerning drug plants, prohibited imports and plant material forming evidence in criminal cases;
- advised on experimental work on algal production in relation to fisheries being carried out by the Fisheries Branch of the Chief Secretary's Department;
- advised the New South Wales Water Conservation and Irrigation Commission concerning the problem of dense algal "bloom" formation at Burrinjuck Dam;
- provided a report on the vegetation of the Buddigower Nature Reserve for the National Parks and Wildlife Service;
- provided various government authorities with technical guidance in horticultural developmental work and assistance with assessment of staff and selection and purchase of specialized park maintenance equipment;
- provided plant material for decorative effect in government offices and government exhibitions of various kinds continues, but not without making heavy inroads into the normal functions of the Royal Botanic Gardens which is a unit of scientific investigation and display.

6.4 GARDENS, DOMAINS AND PARKS

ROYAL BOTANIC GARDENS

The Gardens were satisfactorily maintained and useful improvements made, notwithstanding the continuing difficulty of maintaining staff at full strength and the effects of a heavy cut in maintenance expenditure. Summer floral displays were not at their best due to adverse weather. In January, rainfall in excess of 15 inches over a period of 18 days caused flooding of the Lower Gardens and seriously disrupted maintenance and development works. Nevertheless public interest in the Gardens continues to grow, as indicated by the increasing numbers of people visiting as individuals and groups.

IMPROVEMENTS EFFECTED

Roads and footpaths near the main entrance to Government House and the Victoria Lodge entrance to the Gardens were re-aligned, reformed, and kerbed, while adjacent lawn areas and shrubberies were regraded and replanted. Ornamental plantings generally were extended and in particular, a newly designed garden area was developed to display tropical and subtropical plants. This extensive planting will create considerable interest as it matures and shows to advantage its variety of contrasting foliage forms and colours. The pond near the kiosk was desilted and its stone walling repaired to prevent continual lowering of the water level. Some movable garden seats of new design were set out in prominent areas of the gardens for trial and to gauge public reaction.

PLANT PRODUCTION AND GLASSHOUSES

The nursery and glasshouse sections were combined to form a single unit for producing new and replacement plant material for scientific and display purposes. Liaison and exchange of material with other botanic gardens, as well as specialist plant societies and individuals in Australia and overseas, continues to expand the range and quantity of material under production. Plant and floral decorations were supplied as usual for Parliament House and government exhibitions as well as for certain government offices.

Despite the deteriorating condition of the very old glasshouses, public displays of selected flowering species, ferns, and ornamental foliage plants continued. However, contractors have completed erection and glazing of the aluminium superstructure of the new pyramidal exhibition glasshouse, and this is now an imposing visual feature attracting unprecedented public interest. When design and construction of the internal elevated viewing platforms are completed, the house will be planted and opened for public viewing. The total cost of the glasshouse, believed to be the first of its kind, will approximate \$120,000. New oil-fired boilers to provide heating to this house and all existing units have been installed.

LANDSCAPE DESIGNING AND ASSOCIATED SERVICES

External

The Landscape Design Section inspected and where appropriate prepared reports and plans for the Seven Hills Poultry Research Station grounds; Glenfield Veterinary Research Station grounds; Electricity Commission of N.S.W. coalpit restoration; Cockatoo Dockyards foreshore development; RAAF Base, Richmond, tree preservation; Mosman Municipal Council Civic Library landscaping; Burwood Municipal Council street tree planting; Forbes District Hospital grounds; and the Quirindi Municipal Council, Captain Cook Bi-Centenary feature.

Internal

Apart from directing landscape works associated with general development of the Royal Botanic Gardens and Domains and with restoration and development of Centennial Park, the principal projects comprised the preparation of preliminary plans and reports for landscape development of Government House grounds, preliminary replanning of the Middle Garden area with educational themes in mind, preparation of final plans for the new cactus and succulent garden, paving, and associated landscape treatment of surrounds to the Public Library, landscaping of surrounds to the new wing of the Art Gallery, extension of tree plantings at Centennial Park and further detailed surveys of site features at the Mount Tomah Annexe.

VANDALISM AND SECURITY

Vandalism is a perennial problem. Public toilets, fountains, and floral bedding displays receive most of this unwelcome attention, but plant labels are also damaged, removed, or displaced. During the year four naval ratings were arrested and charged with acts of vandalism in the Gardens. A serious instance of vandalism in Centennial Park was the destruction by explosives of the well-known marble statue of Sir Henry Parkes.

Improved security is expected to follow the creation during the year of three positions of ranger for the Royal Botanic Gardens and Domains on a full-time basis in lieu of the previous arrangement by which part-time watchmen were employed.

THE DOMAINS

The Domain continued to be used for recurrent annual parades and assemblages associated with events of civic and national significance and it remains popular for the traditional public oratory on Sunday afternoons. The long-established lunchtime winter sporting fixtures made maximum use of the limited playing areas available.

The Inner and Outer Domains were satisfactorily maintained, but the use of grassed areas for car parking during transport strikes resulted in considerable damage to lawns and young trees. Construction work within the Domain by contractors engaged on the Eastern Suburbs Railway and extensions to the Art Gallery continued to require close liaison in order to minimize damage to Domain lands and inconvenience to the public.

GOVERNMENT HOUSE

Landscaping proposals, as outlined in the preliminary plan and report prepared by the Senior Landscape Designer, were discussed with His Excellency the Governor and, being well received, implementation of the first stage was begun. Inner Domain staff continued to maintain the grounds and provide interior floral services for Government House.

ADMIRALTY HOUSE

Royal Botanic Gardens staff satisfactorily maintained the grounds of Admiralty House, the Governor-General's Sydney residence, and provided internal floral decorations for the building and for Government House, Canberra.

CENTENNIAL PARK

Restoration and improvement of Centennial Park continued, including desilting of ponds and reformation and grassing of associated embankments. A new shade house was constructed and other plant propagation facilities were upgraded. Renovation and improvement of playing fields continued and facilities for passive and active recreation extended and improved. In particular, one of two Rugby Union fields was completely reformed and returfed, the Queen's Park dressing pavilion was extended, and timber tables and seating as well as litter receptacles of modern design were installed in picnic areas. Interest in and demand for the facilities provided in Centennial Park continued to increase.

MOUNT TOMAH ANNEXE

Funds continue to be unavailable for capital improvements to the 78-acre cool climate annexe in the Blue Mountains. However, with assistance from labour employed with rural unemployment relief funds, activity has chiefly been directed to site clearance and associated work, assembling and establishing nursery stock of ornamental species not in cultivation in the Royal Botanic Gardens, and the lifting and replanting of large stocks of flowering bulb species from scattered locations at the annexe into a holding nursery for later re-establishment in the developed landscape.

APPENDIX I

ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1971-72

The cost of operating the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally-owned property is a charge on the General Loan Account.

In addition to the foregoing sources of funds, the Department is assisted in financing certain specified lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, semi-Governmental and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of "Special Deposits" accounts. The operations on some of the more significant Special Deposits accounts are detailed later in this report.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1970-71	1971-72	Increase or Decrease
	\$	\$	\$
Consolidated Revenue Fund	20,244,176	23,797,174	3,552,998 (Increase)
General Loan Account	1,377,997	1,435,000	57,003 (Increase)
Special Deposits Accounts	13,710,933	15,418,807	1,707,874 (Increase)
	35,333,106	40,650,981	5,317,875 (Increase)

CONSOLIDATED REVENUE FUND EXPENDITURE

Division	1970-71	1971-72	Increase
	\$	\$	\$
Central Administration	3,664,370	4,019,251	354,881
Biological and Chemical Research Institute..	897,500	1,045,382	147,882
Plant Industry	1,107,870	1,248,481	140,611
Horticulture	1,104,969	1,357,116	252,147
Dairying (a)	1,490,392	1,613,109	122,717
Research Stations	1,667,573	2,087,488	419,915
Agricultural Colleges (c)	2,427,513	3,344,712	917,199
Animal Industry—			
Head and District Offices (b)	3,676,767	4,344,468	657,701
Queensland Border	356,548	414,872	58,324
Tick Quarantine Areas	3,112,549	3,512,321	399,772
Royal Botanic Gardens	738,125	819,974	81,849
	20,244,176	23,797,174	3,552,998

	1970-1	1971-2
	\$	\$
(a) Includes—Assistance to North Coast Dairying Industry	500,000	500,000
(b) Includes—State Contribution to Bovine Tuberculosis and Brucellosis Eradication Campaign.. .. .	550,000	640,000
(c) The costs of C. B. Alexander Agricultural College were included under this item for the first time in 1971-2 (previously provided under Special Deposits Account).		

The amounts provided for Assistance to North Coast Dairying Industry (\$500,000) and State contribution to Bovine Tuberculosis and Brucellosis Eradication Campaign (\$640,000) were transferred to Special Deposits Account, details of which are given later in this report.

GENERAL LOAN ACCOUNT EXPENDITURE

	\$
Advanced Education—	
Capital Works financed from State and Commonwealth Contributions (State Contribution) ..	735,000
Condobolin Agricultural Research Station—	
Erection of Cottage (completion)	5,269
Laboratory and Administration Building (completion)	13,343
C. B. Alexander Agricultural College—	
Expenses on Acquisition (final payment)	370,000
Dareton Agricultural Research Station—	
Alternative Irrigation Water Supply (completion)	554
Glenfield Veterinary Research Station—	
Laboratory and Conference Room	7,034
Griffith Viticultural Research Station—	
Experimental Winery	44,272
Hawkesbury Agricultural College—	
Cottage—Senior Dairy Officer (completion)	1,675
Cottage—Senior Technology Officer (completion)	1,675
Narara Horticultural Research Station—	
Screenhouse for Strawberry Certification	3,600
Narrabri Agricultural Research Station—	
Grain Shed	7,558
Orange Agricultural Research Station—	
Orchard Shed	28,623
Queensland Border—	
Cottage at Hebel (completion)	2,401
Cottage at Bonanga (completion)	1,910
Royal Botanic Gardens—	
Exhibition Glasshouse	103,298
Rydalmere Chemical and Biological Research Institute—	
Cotton Testing Laboratory	6,445
Cottage	17,000
Plant Quarantine Station	7,200
Seven Hills Poultry Research Station—	
Laboratory and Administration Building	28,636
Controlled Environment Houses	15,030
Trangie Agricultural Research Station—	
Foreman's Office and Store (completion)	517
Wagga Agricultural College—	
District Veterinary Laboratory	143
Cottage (completion)	1,643
Cottage (completion)	1,642
Wollongbar Agricultural Research Station—	
Dairy Buildings and Bails	8,672
Research Laboratory (completion)	1,860
Extension to Water Supply	20,000
	<u>\$1,435,000</u>

SPECIAL DEPOSITS ACCOUNT

The balances in Special Deposits Account at 1st July, 1971, totalled \$5,698,839. Receipts during the year were \$13,700,068 and expenditure was \$15,418,807 leaving the total of the balances in the Accounts at 30th June, 1972 as \$3,980,100.

Transactions on some of the more significant Special Deposits Accounts during the year were:

COMMONWEALTH GRANTS FOR STATE SECONDARY SCHOOLS—TECHNICAL TRAINING PROJECTS

These funds are made available by the Commonwealth under the States Grants (Technical Training) Acts. Works under the first triennium (1965–6 to 1967–8) were completed at a total cost of \$800,000. Works under the second triennium (1968–9 to 1970–1) have not yet been completed—\$46,115 has yet to be spent. Works under the third triennium, which commenced on 1st July, 1971, have been commenced, with an amount of \$66,690 being spent during 1971–2. Following are the details of expenditure during the financial year ended 30th June, 1972:

<i>Second Triennium (1968–9 to 1970–1):</i>				\$	\$	\$
Grant received from Commonwealth	..	..	..			1,227,000
Previous expenditure to 30th June, 1971	..	..	..		1,139,547	
Expenditure during 1971–2—						
<i>Hawkesbury Agricultural College</i>						
Animal Husbandry Unit	..	..	..	670		
Physics Laboratory and Lecture Room	..			11,635		
PABX Switchboard	..	..	..	2,730		
<i>Wagga Agricultural College</i>						
Animal and Plant Science Laboratory	..			7,199		
<i>Yanco Agricultural College</i>						
Accommodation Block	..	..	..	46		
Animal Demonstration Block	..	..	..	14,126		
Shearing Shed and Yards	..	..	..	4,567		
Purchase of Plant and Equipment	..	..	..	365		
					41,338	
						1,180,885
Balance of funds available to complete second triennium	..					\$46,115
<i>Third Triennium (1971–2 to 1973–4):</i>				\$	\$	\$
Grant received from Commonwealth	..	..	..			2,170,000
Expenditure during 1971–2—						
<i>Hawkesbury Agricultural College</i>						
Student Accommodation Block	..	..	..	404		
Equipment and Teaching Aids	..	..	..	7,329		
<i>Yanco Agricultural College</i>						
Library Building	..	..	..	43,239		
Irrigation Engineering Teaching Laboratory	..			1,314		
Equipment and Teaching Aids	..	..	..	8,663		
Animal Demonstration Unit	..	..	..	5,381		
<i>C. B. Alexander Agricultural College</i>						
Equipment and Teaching Aids	..	..	..	360		
						66,690
Balance of funds available to complete third triennium	..	..				\$2,103,310

COMMONWEALTH GRANTS FOR COLLEGES OF ADVANCED EDUCATION

Commonwealth legislation provides for grants towards State expenditure on advanced education for courses of instruction which comply with the conditions laid down in the Commonwealth Acts. These grants are made for three purposes:

- (1) Financing of major capital projects on a \$1 for \$1 basis by the Commonwealth and State.
- (2) Library purposes in the form of a direct grant from the Commonwealth.
- (3) Recurrent expenditure (running costs). The Commonwealth contributes \$1 for every \$2.85 spent by the State.

Expenditure on the advanced education programmes is summarized as follows:

	\$	\$	\$
(1) Major Capital Projects—			
<i>First Triennium 1st January, 1967 to 31st December, 1969—</i>			
Total Expenditure First Triennium			800,930
<i>Second Triennium 1st January, 1970, to 31st December, 1972—</i>			
Expenditure to 30th June, 1971		946,783	
Expenditure 1971-2—			
Hawkesbury Agricultural College—			
Residential Accommodation	612		
Food Technology Building	94,564		
Steam Heating Facilities	18,711		
Sewerage	72,502		
Student Accommodation Renovations	157,831		
Roadworks	42,838		
Dairy Technology Buildings—Alterations	1,927		
Purchase of Equipment	26,606		
Orange Agricultural College—			
Residential Accommodation	271,485		
Administration Building	6,753		
Lecture Rooms	23,227		
Essential Services—Water Supply, &c.	128,819		
Roadworks	22,132		
Staff Residential Flats	42,940		
Kitchen, Dining Room, and Union Building	11,673		
Purchase of Equipment	14,130		
Sporting Facilities	21,668		
Ancillary Buildings	18,945		
Purchase of Livestock	11,398		
Fencing	4,082		
Construction of Airstrip	2,967		
Irrigation Dam	188		
Landscaping	12,298		
Wagga Agricultural College—			
Residential Accommodation	682		
Animal and Plant Science Laboratory	4,073		
Dining Room and Kitchen	1,680		
Boiler	33,369		
Dairy Buildings	32,117		
Purchase of Equipment	2,496		
Student Accommodation	245,287		
Student Union Building	135,041		
Roadworks	13,736		
Sewerage Treatment Works	47		
Expenditure total for 1971-2		1,476,824	
Total Expenditure—Second Triennium		2,423,607	2,423,607
Total Expenditure all Trienniums			3,224,537
(2) Library Grants—			
Hawkesbury Agricultural College—			
Expenditure to 30th June, 1971		4,686	
Expenditure 1971-2		2,794	7,480
Orange Agricultural College—			
Expenditure to 30th June, 1971		12	
Expenditure 1971-2		242	254
Wagga Agricultural College—			
Expenditure to 30th June, 1971		4,785	
Expenditure 1971-2		3,262	8,047
			\$15,781
(3) Contribution to Recurrent Expenditure—			
Expenditure by the State on Colleges of Advanced Education during 1971-2 was—			
	\$		
Hawkesbury Agricultural College	1,537,185		
Wagga Agricultural College	888,470		
Orange Agricultural College	48,314		
	\$2,473,969		

The State is entitled to a contribution of \$1 for every \$2.85 of the portion of this expenditure which qualifies under the terms of the relevant Commonwealth Act. Courses at Hawkesbury and Wagga were not all fully qualified until 1st January, 1972.

SWINE COMPENSATION FUND

Following is a summary of operations on the Swine Compensation Fund for the year ended 30th June, 1972:

[illegible]

CATTLE COMPENSATION FUND

[illegible]

The following statistical information is supplied in connection with the payment of \$1,157,279 as cattle compensation:

CATTLE COMPENSATION PAYMENTS 1971-72

Disease	Claims (No.)			Animals (No.)			Payments		
	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total
Tuberculosis	609	168	777	1,040	240	1,280	\$ 100,730	\$ 31,113	\$ 131,843
Cancer	10,514	556	11,070	16,332	741	17,073	759,785	55,918	815,703
Actinomycosis	3,100	368	3,468	3,655	19	3,674	147,881	1,935	149,816
Actinobacillosis	1,225	23	1,248	2,123	24	2,147	54,931	2,562	57,493
Pleuro pneumonia con- tagiosa	1	..	1	1	..	1	66	..	66
Trichomoniasis	..	..	..	..	..	..	..	..	..
Tick Fever	3	..	3	9	..	9	1,076	..	1,076
Johne's Disease	9	..	9	9	..	9	852	..	852
Vibriosis	4	..	4	4	..	4	430	..	430
	15,465	1,115	16,580	23,173	1,024	24,197	1,065,751	91,528	1,157,279

ERADICATION OF BOVINE TUBERCULOSIS AND BRUCELLOSIS—WORKING ACCOUNT

							\$	\$
Balance in fund at 1st July, 1971								276
<i>Income—</i>								
Contributions by State								640,000
Contributions by Commonwealth								785,839
								1,426,115
<i>Expenditure—</i>								
Salaries, Wages, and Associated Charges							426,043	
Travelling and Vehicle Running Costs							21,083	
Erection of Laboratory at Glenfield							148,126	
Purchase of Plant and Motor Vehicles							13,904	
Rentals							14,721	
Stores and Equipment							27,197	
Payment to Private Practitioners—								
For TB Testing							445,609	
For Brucellosis Vaccinations							292,600	
Administration Costs							36,801	
								1,426,084
Balance in fund at 30th June, 1972								\$31

COMMONWEALTH EXTENSION SERVICES GRANT

Expenditure from Commonwealth Extension Services Grant over the previous 3 years is summarized below:

	1969-70	1970-71	1971-72
<i>Item</i>	\$	\$	\$
Research Officers	109,492	138,173	193,277
Extension Officers	178,738	223,844	265,212
Field Assistants	134,734	159,097	187,559
Technical and Laboratory Assistants	70,819	90,866	96,365
Research Operating Costs and Service Charges	..	..	55,587
Extension Operating Costs and Service Charges	..	..	32,425
Travelling Expenses and Vehicle Operating Costs	..	..	94,930
Agricultural Trainees	33,336	23,360	30,673
Publications	..	..	20,368
Library Services	15,641	19,523	27,252
Conferences and Study Tours—Overseas	24,534	23,014	18,059
Herd Recording	71,200	71,200	71,200
Conferences, Study Tours—Australia	12,925	10,469	7,919
In Service Training	2,681	5,335	14,238
Post-Graduate Training—Short External Courses	4,395	15,975	12,292
Equipment and Materials	122,092	83,694	10,695
Extension Aids	20,991	20,738	18,787
Motor Vehicles	29,485	49,876	6,715
Capital Items—Major Equipment	..	..	82,328
Buildings and other major Developments	444,221	175,688	100,586
	<u>\$ 1,275,284</u>	<u>1,110,852</u>	<u>1,346,467</u>

ASSISTANCE TO NORTH COAST DAIRY INDUSTRY FEED YEAR SCHEME

A feed year scheme, to run for a period of 5 years, was introduced on 1st October, 1966. The scheme was extended, on a restricted basis, for a further 3 years from 1st October, 1971.

A summary of expenditure is given below:

	\$
1st Scheme Year—commenced 1st October, 1966	1,018,960*
2nd Scheme Year—commenced 1st October, 1967	650,317
3rd Scheme Year—commenced 1st October, 1968	599,410
4th Scheme Year—commenced 1st October, 1969	524,215
5th Scheme Year—commenced 1st October, 1970	478,222
6th Scheme Year—commenced 1st October, 1971	20,316
Total costs to 30th June, 1972	<u>\$3,291,440</u>

* Includes an amount of \$371,945 for initial pasture establishment costs which occurred in the first scheme year only.

NOXIOUS INSECTS DESTRUCTION ACCOUNT

The Noxious Insects Act provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into a Special Deposits Account and applied by the Minister for the purposes of the Act.

Following is a financial statement of the operations on this account during 1971-2:

	\$	\$
Balance at 1st July, 1971	..	730,739
Receipts—		
Levies	..	33,425
		<u>764,164</u>
Payments—		
Contribution to Australian Locust Patrol Service	7,875	
Helicopter and Aircraft Hire	95,234	
Insecticide	262,145	
Travelling Expenses (Departmental)	18,854	
Overtime (Departmental)	16,194	
Pastures Protection Boards—Costs for Salaries, Overtime, &c.	20,373	
Equipment and Sundry Purchases	41,617	
		<u>462,292</u>
Balance in account at 30th June, 1972	..	<u>\$301,872</u>

The balance in the account includes a Treasury advance of \$250,000 received in 1969-70 that has not yet been repaid.

AUSTRALIAN INOCULANTS RESEARCH AND CONTROL SERVICE—WORKING ACCOUNT

Following is a statement of receipts and payments for the above account for the year ended 30th June, 1972:

		\$	\$
Balance in account of 1st July, 1971	.. .. .		11,820
Receipts—			
Contributions from—			
New South Wales	.. .. .	9,000	
Victoria	.. .. .	3,500	
Queensland	.. .. .	4,100	
South Australia	.. .. .	2,700	
Western Australia	.. .. .	7,500	
Tasmania	.. .. .	1,700	
			28,500
			40,320
Payments—			
Salaries	.. .. .	19,508	
Travelling Expenses	.. .. .	1,452	
Operating Expenses	.. .. .	7,202	
Equipment	.. .. .	8,486	
Laboratory Building	.. .. .	3,129	
			39,777
Balance in account at 30th June, 1972	.. .. .		\$543

MISCELLANEOUS ACCOUNTS

VETERINARY SURGEONS ACT

This Act provides for the establishment of a Board of Veterinary Surgeons of New South Wales. Fees and penalties collected are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Board are met.

Following is a statement of receipts and payments for the year ended 30th June, 1972:

RECEIPTS	\$	PAYMENTS	\$
Registration Fees	411	Salaries	2,482
Roll Fees	5,677	Board Fees	937
Restoration Fees	208	Travelling Expenses	15
Examination Fees	420	Postal Expenses	584
Approval to Practice under Supervision Fees	49	Examiners' Fees	225
		Witness Fees	122
		Reporters' Fees	26
		Minor Expenses	21
		Excess of Receipts over Payments	2,353
	\$6,765		\$6,765

Costs of \$740 for printing incurred in 1971–2 have been carried over to 1972–3. Therefore, the real excess of receipts over payments for 1971–2 is only \$1,613.

There were 937 registered Veterinary Surgeons at 30th June, 1972.

MEAT INSPECTION SERVICE

The Meat Inspection Service is administered by virtue of the Meat Industry Act, which makes provision for scale of fees.

Following is a statement of costs in connection with this service for the year ended 30th June, 1972:

	\$
Salaries, Wages, and Associated Charges	1,758,442
Travelling and Motor Running Expenses	79,108
General Stores	9,563
Printing	1,850
Rent, Electricity, Telephone, and Postages	3,606
Sundry Expenses	1,248
	1,853,817
Less fees paid	1,625,045
Net cost of Meat Inspection Service	\$228,772

FUND CREATED BY THE WHEAT MARKETING (BARRING OF CLAIMS) ACT, 1929

Revenue Account for the year ended 30th June, 1972

					\$
Interest on Investments (including Savings Bank Interest)	..	..	..	..	5,504
Less Commitments entered into during year	..	..	..	..	5,307
Balance transferred to Capital Accumulated Fund	..	..	..	..	197

Balance Sheet as at 30th June, 1972

LIABILITIES				ASSETS			
		\$	\$				\$
Accumulated Fund—				Investments in Government Securities (face value)	..	..	103,000
Balance at 1st July, 1971	..	..	103,710	Bank—Commonwealth Saving Bank	..	..	4,821
Add—				Interest—accrued but not paid at 30th June, 1972	..	..	1,067
Uncommitted revenue	..	..	197				
Commitments—							
Previous years—not required	..	..	477				
			104,384				
Commitments at 30th June, 1972	..	..	4,504				
			\$108,888				\$108,888

DAIRY PRODUCTS FACTORY—HAWKESBURY AGRICULTURAL COLLEGE

The operations of the Dairy Products Factory for the financial year ended 30th June, 1972, resulted in a net loss of \$35,087. Losses over previous years have been:

							\$
1970-71	..	..	..	..	..	..	60,547
1969-70	..	..	..	..	..	..	29,262
1968-69	..	..	..	..	..	..	41,932
1967-68	..	..	..	..	..	..	27,450
1966-67	..	..	..	..	..	..	28,778
1965-66	..	..	..	..	..	..	38,694

Details of operations are as follows:

Manufacturing and Trading Account for the year ended 30th June, 1972

							\$
Stock on hand—1st July, 1971	..	..	..	13,845	Sales	..	395,353
Purchases	..	..	..	291,550	Stock on hand 30th June, 1972	..	15,516
Salaries and Wages	..	..	..	49,498			
Depreciation	..	..	..	19,907			
Fuel, Light Power	..	..	..	8,708			
Repairs and Maintenance	..	..	..	22,178			
Water	..	..	..	3,202			
Gross profit	..	..	..	1,981			
				\$410,869			\$410,869

Profit and Loss Account for the year ended 30th June, 1972

							\$
Salaries and Wages and Associated Charges	..	..	..	14,794	Gross Profit	..	1,981
Depreciation	..	..	..	911			
Levies	..	..	..	549			
Sundry Expenses	..	..	..	3,018			
Interest on Capital	..	..	..	17,796	Net loss for 1971-2	..	35,087
				\$37,068			\$37,068

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND

Financial Year 1971-2

										\$	\$
<i>Receipts for Services Rendered—</i>											
Rents	..	..	..	..	..	..	..	..	..	97,330	
Students' Fees	..	..	..	..	..	..	..	..	..	253,862	
<i>Fees—</i>											
Examinations	..	..	..	..	..	..	..	..	..	604	
Witnesses and Jurors	..	..	..	..	..	..	..	..	..	171	
Apiary Registrations	..	..	..	..	..	..	..	..	..	5,226	
Dairy Industry	..	..	..	..	..	..	..	..	..	905	
Farm Produce Agents	..	..	..	..	..	..	..	..	..	561	
Fertilizers Act	..	..	..	..	..	..	..	..	..	1,295	
Pest Destroyers Act	..	..	..	..	..	..	..	..	..	3,497	
Poultry Processing Act	..	..	..	..	..	..	..	..	..	840	
Stock Brands Registrations	..	..	..	..	..	..	..	..	..	9,926	
Swine Brands Registrations	..	..	..	..	..	..	..	..	..	542	
Stock Foods and Medicines Act	..	..	..	..	..	..	..	..	..	9,382	
Veterinary Surgeons Act	..	..	..	..	..	..	..	..	..	6,765	
<i>Contributions from Commonwealth—</i>											
For Administration of Plant Quarantine	..	..	..	..	..	..	..	..	..	516,860	
For Administrative of Animal Quarantine	..	..	..	..	..	..	..	..	..	205,000	
For Administration of Commerce Act	..	..	..	..	..	..	..	..	..	126,971	
For Maintenance of Gardens at Admiralty House	..	..	..	..	..	..	..	..	..	18,277	
<i>Fees—</i>											
Inspection under Plant Industry Act	..	..	..	..	..	..	..	..	..	556	
Inspection under Meat Industry Act	..	..	..	..	..	..	..	..	..	1,625,045	
Herd Recording	..	..	..	..	..	..	..	..	..	223,717	
Seed Certification and Testing	..	..	..	..	..	..	..	..	..	23,347	
Miscellaneous	..	..	..	..	..	..	..	..	..	62,297	
A.D.P. Service Bureau Charges	..	..	..	..	..	..	..	..	..	146	
Administration of Cattle Compensation Fund	..	..	..	..	..	..	..	..	..	16,430	
Administration of Swine Compensation Fund	..	..	..	..	..	..	..	..	..	5,333	
Commission on Premiums Collected	..	..	..	..	..	..	..	..	..	9,052	
Miscellaneous Receipts for Services Rendered	..	..	..	..	..	..	..	..	..	48,374	
Total	..	..	..	..	..	..	..	..	..		3,272,311
<i>General Miscellaneous Receipts—</i>											
Rents (excluding Land, Building, and Premises)	..	..	..	..	..	..	..	..	..	11,377	
Fines and Forfeitures (including Bond Liabilities)	..	..	..	..	..	..	..	..	..	19,949	
Interest	..	..	..	..	..	..	..	..	..	825	
Sale of Farm Produce and Livestock	..	..	..	..	..	..	..	..	..	473,897	
Sale of Government Property	..	..	..	..	..	..	..	..	..	7,939	
Contribution by Commonwealth in respect of Cattle Tick Control	..	..	..	..	..	..	..	..	..	449,927	
Repayment to credit of Previous Years Votes	..	..	..	..	..	..	..	..	..	257,456	
Transfers of Part Balances of Special Deposits Accounts no longer required	..	..	..	..	..	..	..	..	..	142	
Miscellaneous Unclassified Receipts	..	..	..	..	..	..	..	..	..	1,281	
Pastures Protection Boards—3 per cent Contributions	..	..	..	..	..	..	..	..	..	70,034	
Employer's Liability to State Superannuation Fund	..	..	..	..	..	..	..	..	..	241,086	
Commonwealth Grant—Herd Recording	..	..	..	..	..	..	..	..	..	71,200	
Commonwealth Payments—Advanced Education—Recurrent Expenditure	..	..	..	..	..	..	..	..	..	283,505	
Recovery of On-costs on Salaries of Officers assisting Other Departments	..	..	..	..	..	..	..	..	..	418	
Total	..	..	..	..	..	..	..	..	..		1,889,036
TOTAL—ALL RECEIPTS	..	..	..	..	..	..	..	..	..		\$5,161,347

APPENDIX II

PUBLICATIONS 1971-72

The publications listed have been classified as: Department of Agriculture (D. of A.) bulletins, booklets, leaflets; contributions to journals, including the Department's journals—the *Agricultural Gazette of New South Wales*, the *Review of Marketing and Agricultural Economics*, *Dairy Topics*, *Poultry Notes*, and *Veterinary Notes*—as well as journals of other organizations; papers presented at technical conferences for which there are published records; and theses presented for higher degrees.

The appendix does not list the much greater volume of items published as news and information releases for press, radio and television, newspaper supplements and newsletters for specific areas or groups of primary producers.

DIVISION OF EXTENSION SERVICES

D. of A. Bulletins, Booklets, Leaflets

Gidley, V. N. (1972). A Directory of Agricultural Research and Extension Personnel.

Contributions to Journals

Campbell, D. G. (1971). The Agricultural Engineering Research Centre. *Agric. Gaz. N.S.W.* 82: 288.

Campbell, D. G. (1972). Operation plague locust. *Agric. Gaz. N.S.W.* 83: 160.

Potter, J. N. with Brien, J. P. (Uni. Syd.) (1972). Agricultural scientists and technologists not news and review readers. *J. Aust. Inst. agric. Sci.* 38: 120.

Contributions to Technical Conferences

Slater, J. J. (1972). Current training and development programmes for extension officers in N.S.W. Proc. Nat. Workshop on In-Service Training and Development of Extension Workers, Brisbane.

Post-Graduate Thesis

Petruchenia, M. V. (1972). Relating theory and research in agricultural extension in Australia. M.Sc. Thesis, Univ. of N.S.W.

DIVISION OF ANIMAL INDUSTRY

Contributions to Journals

Ackland, H. M., Gard, G. P., and Plant J. W. (1972). Infection of sheep with a mucosal disease virus. *Aust. vet. J.* 48: 70.

Ahrens, P. J. (1971). Diseases associated with lot feeding of cattle. *Vet. Inspector* 34: 23.

Baillie, B. G. (1972). Evaluation of feed grade biuret. *Agric. Gaz. N.S.W.* 83: 10.

Barker, J. B. (1971). Congenital apalsia of the bile ducts in lambs. *Vet. Inspector* 34: 39.

Barry, M. R. (1971). Bushfire—what to do with injured stock? *Agric. Gaz. N.S.W.* 82: 208.

Bayfield, R. F., Saville, D. G., and Falk, R. H. (1972). Vitamin A deficiency in drought fed sheep. *Aust. J. exp. Agric. Anim. Husb.* 12: 19.

Beeby, L. D. (1971). Management of the beef heifer. *Agric. Gaz. N.S.W.* 82: 202.

Beh, K. J. H. (1971). The incidence of enteropathogenic *Escherichia coli* serotypes and *Salmonella* spp in pigs in N.S.W. *Aust. vet. J.* 47: 379.

Bell, A. K. (1972). Mulesing in N.S.W. *Agric. Gaz. N.S.W.* 83: 146.

Bolla, J. K. (1971). Factors influencing incidence of cracked eggs and blood spots. *Poultry Notes* July: 2.

Brunskill, A. and Archer, W. R. (1972). Practical economics in sheep management. *Agric. Gaz. N.S.W.* 83: 75.

Carter, G. C. (1972). The dog tick—a cause of paralysis and death in dogs. *Agric. Gaz. N.S.W.* 83: 109.

Cohen, R. D. H., Eastoe, R. D., Hotson, I. K., and Smeal, M. G. (1972). Sheep production on the North Coast of N.S.W. 1. Effect of anthelmintic treatment and grazing management on production and gastro-intestinal helminthosis of Merino wethers. *Aust. J. exp. Agric. Anim. Husb.* 12: 247.

Dent, G. H. R. (1971). Post-graduate studies overseas. *Vet. Inspector* 34: 38.

Doughty, F. R. (1971). Neurofibroma of cattle in N.S.W. *Vet. Inspector* 34: 43.

Doughty, F. R. (1972). *Toxocara vitulorum*, the infection in calves in northern N.S.W. *Aust. vet. J.* 48: 62.

Doughty, F. R. (1972). Virus particles in a bovine neurofibroma. *Aust. vet. J.* 48: 365.

Evans, F. W. (1972). Progress and eradication of bovine tuberculosis and brucellosis in N.S.W. and the efficacy of a trace back system. *Aust. vet. J.* 48: 156.

Farleigh, E. A. (1971). Method of numbering cattle. *Vet. Inspector* 34: 40.

Fogarty, N. M. (1971). Some aspects of lamb losses in Dorset and Border Leicester sheep. *Wool Technol. and Sheep Breed.* 18: 20.

- Fogarty, N. M. (1972). Crossbreeding for lamb production. 1. Survival and growth of first cross lambs. *Aust. J. exp. Agric. Anim. Husb.* 12: 234.
- Freer, R. E. (1971). Drought feeding of beef cattle. *Agric. Gaz. N.S.W.* 82: 367.
- Gibbs, H. M. (1971). Bulk handling of eggs. *Poultry Notes* October: 2.
- Gibbs, H. M. (1971). Daylight saving lighting for layers. *Poultry Notes* October: 12.
- Glastonbury, J. R. W. (1972). Pregnancy diagnosis in beef cattle. *Agric. Gaz. N.S.W.* 83: 45.
- Hall, R. A. (1971). Control of livestock slaughtering in N.S.W. *Vet. Inspector* 34: 20.
- Healey, J. S. (1971). Livestock Health. *Agric. Gaz. N.S.W.* 82: 215, 298, 357.
- Healey, J. S. (1972). Livestock Health. *Agric. Gaz. N.S.W.* 83: 36, 82, 154.
- Healy, B. P. (1971). Foot abscess in sheep. *Agric. Gaz. N.S.W.* 82: 241.
- Healy, P. J. (1971). Serum alkaline phosphatase in sheep. *Clinica chim. Acta.* 33: 431.
- Healy, P. J. (1971). Serum alkaline phosphatase in the newborn lamb. *Clinica chim. Acta.* 33: 437.
- Henry, E. S. (1971). Performance testing as an aid in bull selection. *Agric. Gaz. N.S.W.* 82: 225.
- Hoare, R. J. T. (1971). Yellow stain on filter discs and its relationship to mastitis. *Aust. J. Dairy Technol.* 26: 104.
- Hoare, R. J. T. (1972). Testing with the Rapid Mastitis Test. *Dairy Topics* 17: 6.
- Hoare, R. J. T. and Claxton, P. D. (1972). Observations on *Leptospira hardjo* infection in N.S.W. *Aust. vet. J.* 48: 228.
- Holst, P. J. and Braden, A. W. H. (1972). Ovum transport in the ewe. *Aust. J. biol. Sci.* 25: 167.
- Holst, P. J., Braden, A. W. H. (CSIRO), and Mattner, P. E. (CSIRO) (1972). Oestradiol-17 secretion from the ewe ovary and related ovarian morphology on days 2 and 3 of the cycle. *J. Reprod. and Fert.* 28: 136.
- Hunt, E. R. (1972). Hepatotoxicity of carbon tetrachloride—influence of ingestion of *Heliotropium europaeum*. *Aust. vet. J.* 48: 57.
- Hamilton, B. A., with Hutchinson, K. F. (CSIRO), and McLean, R. W. (1972). The visual estimation of pasture and availability using standard pasture cores. *J. Br. Grasslnd Soc.* 27: 29.
- Jackson, C. A. W., Lindsay, M. J. (private ind.), and Shiel, F. (private ind.) (1971). A study of the epizootiology and control of *Salmonella typhimurium* infection in a commercial poultry organization. *Aust. vet. J.* 47: 485.
- Jeffery, H. J. (1971). The relation between various energy parameters, chemical composition and digestibility of some pasture swards grown in a sub-tropical environment. *Aust. J. exp. Agric. Anim. Husb.* 11: 397.
- Jeffery, H. J. (1971). An assessment of faecal nitrogen as an index for the estimation of digestibility and intake of food by sheep consuming *Pennisetum clandestinum* based pastures. *Aust. J. exp. Agric. Anim. Husb.* 11: 393.
- Jeffery, H. J. (1971). Supplementary feeding for dairy production in the tropical regions of Australia. 1. Review of literature. *Trop. Grasslnd* 5: 205.
- Jeffery, H. J., Colman, R. L., and Swain, F. G. (1971). Milk production from a naturalized pasture at Wollongbar and its relation to rainfall. *Aust. J. exp. Agric. Anim. Husb.* 11: 604.
- Jeffery, H. J. and Holder, J. M. (1971). The nutritive value of some pasture species examined in a subtropical environment. *Trop. Grasslnd* 5: 117.
- Kajons, A. (1972). Dorset x Merino ewes for reliable spring joining. *Agric. Gaz. N.S.W.* 83: 87.
- Needham, D. J. (1972). Control cattle lice early. *Agric. Gaz. N.S.W.* 83: 120.
- Nowland, W. J. (1971). The 1971 Random Sample Broiler Test. *Poultry Notes* October: 6.
- Nowland, W. J. (1972). Hawkesbury New Equipment Award for 1971. *Poultry Notes* January: 8.
- Nowland, W. J. (1972). Raising guinea fowl. *Poultry Notes* April: 2.
- Nowland, W. J. (1972). Pheasant, guinea fowl, and quail. *Annual Pig and Poultry News* 1972-73: 25.
- Roberts, B. C. (1971). Tooth wear and tooth clipping. *Agric. Gaz. N.S.W.* 82: 262.
- Royal, A. J., with Scott, T. W. (CSIRO), Brady, P. J. (CSIRO), and Cook, L. J. (CSIRO) (1972). Oil seed supplements for the production of polyunsaturated ruminant milk fat. *Search* 3: 170.
- Ryan, D. M. (1972). Supplementary feeding of beef cattle. *Agric. Gaz. N.S.W.* 83: 130.
- Ryan, G. E. (1972). Which bait for rabbits? *Agric. Gaz. N.S.W.* 83: 92.
- Saville, D. G., Gleeson, A. C., and McManus, W. R. (Univ. N.S.W.) (1971). Drought feeding of sheep. 2. Wool growth and bodyweight of three types of Merinos on oat based diets supplemented with formaldehyde treated cottonseed meal. *Aust. J. exp. Agric. Anim. Husb.* 11: 488.
- Saville, D. G. (1972). Differences in wool production between some Merino strains. *Agric. Gaz. N.S.W.* 83: 23.
- Saville, D. G. and Robards, G. E. (1972). Efficiency of conversion of food to wool in selected and unselected Merino types. *Aust. J. agric. Res.* 23: 117.
- Slennett, G. D. (1971). Overseas developments—wire mesh or wool slat floors for fertile egg production. *Poultry Notes* July: 7.
- Slennett, G. D. (1972). Seven Hills Poultry Research Station—Review of developments, 1971. *Poultry Notes* April: 4.
- Slennett, G. D. (1972). Housing of layers—the overseas scene. *Poultry Notes* January: 15.
- Slennett, G. D. (1972). Labour and egg shell damage. *Annual Pig and Poultry News* 1972-3: 16.
- Williams, L. G., with Osborne, H. G. (Univ. Qld.) and Galloway, D. B. (Univ. Melb.) (1971). A test in libido and serving ability in beef bulls. *Aust. vet. J.* 47: 465.

Yule, W. J. (1972). Protein requirements of male and female Australian White Turkeys to 8 weeks of age. *Aust. J. exp. Agric. Anim. Husb.* 12: 252.

Contributions to Technical Conferences

Bolla, J. K. (1972). New uses for broiler litter. Proc. N.S.W. Dept. Agric. Poult. Seminar. E: 1.

Chaseling, P. D. (1972). Restricted feeding programmes for pullets. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 73.

Dillon, J. F. and Herbert, L. S. (CSIRO) (1972). The influence of pressure treatment during rendering, amount of bone and feed intake on the comparative nutritive value of meatmeals. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 39.

Dillon, J. F. and Mohr, G. M. (1972). The influence of nutrient density and dietary protein on feed intake, production and the efficiency of nutrient utilization of crossbred layers. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 25.

Gibbs, H. M. and Pym, R. A. E. (1972). The effect of egg storage temperature and humidity on albumen quality. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 33.

Horne, R. G. (1972). High pressure gas brooding. Proc. N.S.W. Dept. Agric. Poult. Seminar. G: 1.

Jackson, C. A. W., Biggs, P. M. (Poult. Res. Stat., Houghton, U.K.), Bell, R. A. (Min. Agric. and Fish, U.K.), Lancaster, M. L. (Harper Adams Agric. Coll., U.K.) and Milne, B. S. (Poult. Res. Stat., Houghton, U.K.) (1971). A vaccination study with attenuated Marek's disease virus. Proc. Conf. Oncogenesis and Herpes-type Viruses, University of Cambridge.

Jackson, C. A. W. (1972). Marek's disease—recent research and perspectives. Proc. N.S.W. Dept. Agric. Poult. Seminar. T: 1.

Jackson, C. A. W., Biggs, P. M. (Poult. Res. Stat., Houghton, U.K.), Bell, R. A. (Min. Agric. and Fish, U.K.), Lancaster, M. L. (Harper Adams Agric. Coll., U.K.), and Milne, B. S. (Poult. Res. Stat., Houghton, U.K.) (1972). Vaccination against Marek's disease with attenuated Marek's disease virus in a commercial egg laying flock. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 229.

Keast, J. C. (1971). The Australian Meat Research Committee and the supported research projects in poultry production and the new environment. Proc. 7th Conf. Aust. Chicken Meat Fed., Sydney. 120.

Keys, M. J. (1972). Methods of controlling the maturity of replacement pullets. Proc. N.S.W. Dept. Agric. Poult. Seminar. K: 1.

Littlejohns, I. (1972). Diagnostic virology. Proc. No. 16. Virology and virus diseases, post-graduate committee. Vet. Sci., Univ. Sydney.

Nowland, W. J. and Horn, R. G. (1971). Improvement of brooding techniques. Proc. 7th Conf. Aust. Chicken Meat Fed., Sydney. 134.

Nowland, W. J. (1972). Advances in brooding. Proc. N.S.W. Dept. Agric. Poult. Seminar. F: 1.

Nowland, W. J. and Horn, R. G. (1972). Improved brooding methods for broiler and laying strain chickens. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 45.

Pym, R. A. E., and Dillon, J. F. (1972). Controlled feed intake and reproductive performance of two commercial strains of broiler breeder pullets. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 173.

Sheridan, A. K. (1972). Hybrid vigour and egg production parameters in the White Leghorn—Australorp crossbred. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 167.

Slennett, G. D. (1971). Traditional broiler housing. Proc. 7th Conf. Aust. Chicken Meat Fed., Sydney. 42.

Slennett, G. D. (1972). Egg handling. Proc. N.S.W. Dept. Agric. Poult. Seminar. N: 1.

Slennett, G. D. (1972). Developments in housing for broilers in New South Wales. Proc. Poult. Information Exchange, Queensland.

Yule, W. J. (1972). Stocking density for broilers in controlled environment houses. Proc. 1972 Australasian Poult. Sci. Conv., Auckland. 17.

Post-Graduate Theses

Jeffery, H. J. (1971). The nutritive value of sub-tropical pasture species with some reference to the dairy industry of the North Coast of N.S.W. M.V.Sc. thesis, Univ. of Sydney.

Holst, P. J. (1972). Ova studies in the ewe with particular reference to ovum transport. Ph.D. thesis, Macquarie Univ.

Pym, R. A. E. (1971). The genetic correlation between feed conversion and growth rate in broiler chickens. M.Sc. thesis, Univ. of N.S.W.

Robards, G. E. (1972). Studies on intake of roughage by sheep with particular reference to frequency of feeding. Ph.D. thesis, Univ. of Melbourne.

Saville, D. G. (1972). Drought feeding of sheep for production. M.Sc. thesis, Univ. of N.S.W.

Smeal, M. G. (1972). Studies on helminthosis in beef cattle. M.V.Sc. thesis, Univ. of Sydney.

DIVISION OF DAIRYING

Contributions to Journals

Arkell, D. G. (1972). Milking efficiency assessed with the slow speed recorder. *Dairy Topics* 17: 32.

Armfield, L. K. (1972). Tropical legumes on ridges. *Dairy Topics* 17: 34.

Auld, R. L. R. (1971). Sire survey of A.I. bulls. *Dairy Topics* 16: 40.

Auld, R. L. R. (1971). Dairy herd improvement. *Dairy Topics* 16: 3.

- Auld, R. L. R. (1971). Some elementary herd improvement genetics. *Dairy Topics* 16: 5.
- Auld, R. L. R. (1971). Seeking the top proven bull. *Dairy Topics* 16: 27.
- Battese, D. F. (1971). Milk from orange peel. *Dairy Topics* 16: 34.
- Bourne, I. R. (1972). Don't waste detergents. *Dairy Topics* 17: 38.
- Chittick, J. B. (1972). Confidence in inland dairying. *Dairy Topics* 17: 25.
- Chittick, J. B. (1972). The Kelly girls of Gilmore. *Dairy Topics* 17: 20.
- Coomber, A. R. (1971). Research measures production. *Dairy Topics* 16: 46.
- Cox, D. (1971). Good milk earns more. *Dairy Topics* 16: 24.
- Critchley, D. J. (1972). Air filter for releaser. *Dairy Topics* 17: 39.
- Curtin, W. T. (1971). Modified Awahuri unit. *Dairy Topics* 16: 19.
- Davidson, H. M. (1971). Concrete surface pattern reduces slipping. *Dairy Topics* 16: 9.
- Davidson, H. M. (1972). Strip grazing, feeding, and watering for high production. *Dairy Topics* 17: 4.
- Dowling, J. F. (1972). Machine milking pulsators. *Dairy Topics* 17: 41.
- Dowman, A. J. (1972). The Calendar Wheel aids farm management. *Dairy Topics* 17: 23.
- Dykes, L. S. (1972). Water supplies and milk quality. *Dairy Topics* 17: 32.
- Dykes, L. S. (1972). Why tolerate a fly plague? *Dairy Topics* 17: 41.
- Hart, C. K. (1971). Today's bottle of milk. *Dairy Topics* 16: 10.
- Heptonstall, D. B. (1971). Friesian bull for A.B. *Dairy Topics* 16: 29.
- Heptonstall, D. B. (1971). Rearing calves by early weaning. *Dairy Topics* 16: 41.
- Heptonstall, D. B. (1972). Illawarras for Tocal. *Dairy Topics* 17: 7.
- Heptonstall, D. B. (1972). A.B. Sire Survey. *Dairy Topics* 17: 44.
- Hollis, A. N. (1972). Conversion to step-up bails. *Dairy Topics* 17: 44.
- Hollis, A. N. (1972). Cable irrigator saves labour. *Dairy Topics* 17: 9.
- Logue, I. J. (1971). Second grade butter makes good cheese. *Dairy Topics* 16: 30.
- Logue, I. J. (1972). The Whiteside test and sub-clinical mastitis. *Dairy Topics* 17: 30.
- Lysaght, O. G. (1971). Sire survey by R.G.V. *Dairy Topics* 16: 18.
- Macindoe, A. W. (1972). Cut farm water costs. *Dairy Topics* 17: 30.
- Noble, W. S. (1971). Ring the milk robbers. *Dairy Topics* 16: 38.
- Noble, W. S. (1972). Dairy farm management. *Dairy Topics* 17: 3.
- O'Loughlin, P. J. (1971). Copper harms milk products. *Dairy Topics* 16: 33.
- Potts, A. K. (1971). Stainless steel needs care. *Dairy Topics* 16: 28.
- Potts, A. K. and McLeod, S. (D.I.Auth.) (1972). Flat roof milking shed. *Dairy Topics* 17: 46.
- Rathore, A. K. (1971). The future and dairy beef. *Dairy Topics* 16: 3.
- Rathore, A. K. (1971). Breeding for milk quality. *Dairy Topics* 16: 21.
- Rathore, A. K. (1971). Feeding the herd. *Dairy Topics* 16: 34.
- Rathore, A. K. (1971). Advantage and future of raising goats. *Aust. Goat World* 23 (5): 1.
- Rathore, A. K. (1971). General physiology of the goat. *Aust. Goat World* 23 (6): 1.
- Richardson, A. O. (1971). Southern Riverina dairying. *Dairy Topics* 16: 6.
- Salkeld, J. N. (1972). Too many sets of cups. *Dairy Topics* 17: 37.
- Scott, D. R. (1971). Awahuri Electric Branding Unit. *Dairy Topics* 16: 14.
- Stevens, G. J. (1972). Low cost bail feeders. *Dairy Topics* 17: 36.
- Stevens, G. J. (1972). Selecting a least cost concentrate. *Dairy Topics* 17: 25.
- Ubrighien, C. M. (1972). The State's most modern cheese factory. *Dairy Topics* 17: 15.
- Ware, B. H. (1971). Culling for dairy herd improvement. *Dairy Topics* 16: 30.
- Ware, B. H. (1972). Facing S.N.F. standards. *Dairy Topics* 17: 28.
- Wilson, J. C. (1971). Be a good psy-"cow"-logist. *Dairy Topics* 16: 38.
- Wilson, J. C. (1972). More on calf rearing. *Dairy Topics* 17: 11.

Contributions to Technical Conferences

- Rathore, A. K. (1971). Raising goats in Australia. 11th Internat. Conf. about Goat Breed., Paris.
- Rathore, A. K. (1971). Angora goat and mohair industries of Australia. 11th Internat. Conf. about Goat Breed., Paris.
- Rathore, A. K. (1972). Benefits of milk recording in dairy goats for improved breeding. Symposium on Milk Recording Practices for Sheep and Goats, Tel-Aviv.

DIVISION OF HORTICULTURE

D. of A. Bulletins, Booklets, Leaflets

- Anon. (1971). Pest and disease control programme for peaches, nectarines, plums, and apricots grown in coastal districts.
- Anon. (1972). Citrus spray guide—Inland irrigation districts. *Bull.* H217.
- Anon. (1972). Citrus spray guide—Coastal districts. *Bull.* H218.
- Chaseling, J. C. (1972). Fruitgrowing in the Richmond River district. *Bull.* H226.
- Leigh, D. S. (1972). Some fruits for warmer climates. *Bull.* H134.

Contributions to Journals

- Beattie, B. B. with Baxter, R. I. (CSIRO) and Hall, E. G. (CSIRO) (1972). The development of exponential equations to predict ripening of pears during and after cool storage. CSIRO, Div. Math. Stat., Tech. Paper No. 36.
- Beattie, B. B., Hall, E. G. (CSIRO), Coote, G. G. (CSIRO), and Baxter, R. I. (CSIRO) (1971). Effects of temperature and time in cool storage on the ripening and storage life of pears. *Aust. J. exp. Agric. Anim. Husb.* 11: 576.
- Beattie, B. B., Hall, E. G. (CSIRO), Coote, G. G. (CSIRO), and Baxter, R. I. (CSIRO) (1972). A study of the storage and ripening of pears. CSIRO, Div. Fd. Res., Tech. Paper No. 36.
- Beattie, B. B. with Harper, K. A. (CSIRO) (1971). Apricot breakdown, quality defect in canned apricots. *Fd. Res. Qrt.* 31: 33.
- Beattie, B. B. with Harper, K. A. (CSIRO), Pitt, J. I. (CSIRO), and Best, D. J. (CSIRO) (1972). Texture changes in canned apricots following infection of the fresh fruit with *Rhizopus stolonifer*. *J. Sci. Fd. Agric.* 23: 311.
- Beattie, B. B., Wild, B. L., and Coote, G. G. (CSIRO) (1972). Maturity and acceptability of early-picked Granny Smith apples for export. *Aust. J. exp. Agric. Anim. Husb.* 12: 323.
- Forsyth, J. B. (1971). Comparison of two sources of nitrogen for peach trees. *Agric. Gaz. N.S.W.* 82: 227.
- Fuller, E. J. (1971). Preparing for a competitive market. *Agric. Gaz. N.S.W.* 82: 218.
- Leigh, D. S. (1971). Propagation of macadamia. *Agric. Gaz. N.S.W.* 82: 333.
- Rippon, L. E. (1972). An evaluation of thiophanate methyl for the control of crown rot of banana hands. *Aust. J. exp. Agric. Anim. Husb.* 12: 185.
- Scott, K. J. (1971). Polyethylene bags and ethylene absorbent for transporting bananas. *Agric. Gaz. N.S.W.* 82: 267.
- Scott, K. J., Wills, R. B. H. (CSIRO), and Patterson, B. D. (E. Malling F.R.S., U.K.) (1971). Removal by ultra-violet lamp of ethylene and other hydrocarbons produced by bananas. *J. Sci. Fd. Agric.* 22: 496.
- Scott, K. J. with Wills, R. B. H. (CSIRO) (1971). Chemical induction of low temperature breakdown of apples. *Phytochemistry* 10: 1783.
- Scott, K. J., Blake, J. R. (Q.D.P.I.), Strachan, G. (DSIR), Tugwell, B. L. (D.A., S.A.), and McGlasson, W.G. (CSIRO) (1971). Transport of bananas at ambient temperatures using polyethylene bags. *Trop. Agric. Trin.* 48: 245.
- Scott, K. J. and Wills, R. B. H. (CSIRO) (1972). Ethylene produced by plastics in sunlight. *Hort. Sci.* 7: 177.
- Scott, L. A. (1971). Fruitgrowing in the Gosford district. *Agric. Gaz. N.S.W.* 82: 232.
- Turner, D. W. (1972). Banana plant growth. 1. Gross morphology. *Aust. J. exp. Agric. Anim. Husb.* 12: 209.
- Turner, D. W. (1972). Banana plant growth. 2. Dry matter production, leaf area and growth analysis. *Aust. J. exp. Agric. Anim. Husb.* 12: 216.
- Turner, D. W. (1972). Effects of climate on rate of banana leaf production. *Trop. Agric. Trin.* 48: 283.
- Wade, N. L., O'Connell, P. B. H. (CSIRO), and Brady, C. J. (CSIRO) (1972). Content of R.N.A. and protein of the ripening banana. *Phytochemistry* 11: 975.

DIVISION OF PLANT INDUSTRY

D. of A. Bulletins, Booklets, Leaflets

- Anon. (1971). Celery growing. *Bull.* P19.
- Anon. (1971). Sunflower production.
- Anon. (1972). Hop growing.
- Anon. (1972). Rapeseed for oil production.
- Boyle, J. W. (1971). Cowpeas (*Vigna sinensis*).
- Boyle, J. W. and Johnson, R. I. (1971). Growing grain sorghum in New South Wales. *Bull.* P223.
- Colman, R. L. *et al.* (1972). Kikuyu grass (*Pennisetum clandestinum* Hochst).

Contributions to Journals

- Auld, B. A. (1972). Chemical control of *Eupatorium adenophorum*, Crofton weed. *Trop. Grassld.* 6: 55.
- Ballard, J. H. (1971). Seed certification scheme. *Agric. Gaz. N.S.W.* 82: 207.
- Betts, J. E. (1972). Lotononis. *Agric. Gaz. N.S.W.* 83: 117.

- Boerema, E. B. (1972). Rice establishment methods under temperate conditions. *Ricemill News* 9: 27.
- Boerema, E. B. (1972). Development of in-water and drill-sown varieties. *Ricemill News* 9: 33.
- Claxton, R. A. and Cutting, F. W. (1971). Irrigated soybeans in N.S.W. *Agric. Gaz. N.S.W.* 82: 281.
- Colless, J. M. (1972). GH390—a new maize hybrid for coastal N.S.W. *Agric. Gaz. N.S.W.* 83: 72.
- Colman, R. L. (1971). Quantity of pasture and forage crops for dairy production in the tropical regions of Australia. Review of the literature. *Trop. Grassld.* 5: 181.
- Cornish, P. S. (1971). Pasture species research—Agricultural Research Station, Condobolin. *Arid Zone Newsl.* 46.
- Cornish, P. S. (1971). The future of plant introduction in the low rainfall wheat belt of central N.S.W. *CSIRO Plant Introd. Rev.* 8: 3.
- Corbin, E. J. and Bradley, J. (1971). Grain yield and protein response in wheat to varying times of application of two nitrogen fertilizers. *Aust. Cereal Agron. Res. Newsl.* 6: 59.
- Corbin, E. J. (1972). Factors affecting nitrogen and phosphorus requirements of wheat in central western N.S.W. *Agric. Gaz. N.S.W.* 83: 39.
- Downey, L. A. (1971). Physical problems and their amelioration in salty soils. *J. Aust. Inst. agric. Sci.* 37: 314.
- Downey, L. A. (1972). Effect of varying plant density on a tillering variety of maize. *Expl. Agric.* 8: 25.
- Fitzsimmons, R. W. (1971). Performance of Halberd wheat in N.S.W. *Aust. Cereal Agron. Res. Newsl.* 6: 15.
- Fitzsimmons, R. W. (1971). Performance of Darkan wheat in N.S.W. *Aust. Cereal Agron. Res. Newsl.* 6: 15.
- Freebairn, R. D. (1972). Lucerne establishment on light soils in the central west and northwest of N.S.W. *Agric. Gaz. N.S.W.* 83: 143.
- Gammie, R. L. (1972). Scotch thistles are spreading. *Agric. Gaz. N.S.W.* 83: 79.
- Holland, J. F., Sheridan, K. P., Thompson, J. A., and Hamilton, B. A. (1971). Growth rates of lambs and adult sheep grazing forage sorghum and lucerne. *Aust. J. exp. Agric. Anim. Husb.* 12: 144.
- Launders, T. E. (1971). Comparative study of native pastures and grazing lucerne. *Arid Zone Newsl.* 47.
- Launders, T. E. (1971). Which is the best lucerne variety for the northwest plains? *Agric. Gaz. N.S.W.* 82: 264.
- Launders, T. E. (1971). Cheap hay from surplus burr medic. *Agric. Gaz. N.S.W.* 82: 337.
- Lewin, L. G. (1972). Desiccant trials to boost efficiency of harvesting. *Ricemill News* 9: 29.
- McNamara, D. W. (1972). Wild oats in wheat. *Agric. Gaz. N.S.W.* 83: 157.
- Mead, J. A. (1971). Mechanisation of the harvest/post harvest process. *Aust. Tobacco Growers Bull.* 19: 25.
- Mead, J. A., Ward, D. K. (QDPI), and Gude, J. (QDPI) (1971). Irrigation—how the systems compare. *Aust. Tobacco Growers Bull.* 19: 13.
- Meakins, L. (1971). Evaluation of alternative crops to wheat at Dubbo. *Aust. Cereal Agron. Res. Newsl.* 6: 36.
- Meakins, L. (1972). Namoi woolly pod vetch. *Agric. Gaz. N.S.W.* 83: 112.
- Mears, P. T. with Luck, P. E. (QDPI), and Pulsford, J. S. (private ind.) (1971). Pelleting and fertilizer effects on nodulation of *Glycine wightii*. *Trop. Grassld.* 5: 81.
- Mullen, C. L. (1971). Time and method of superphosphate application to wheat. *Aust. Cereal Agron. Res. Newsl.* 6: 40.
- Mullen, C. L. and Corbin, E. J. (1972). Sowing rates for wheat in the lower rainfall areas of the central west. *Agric. Gaz. N.S.W.* 83: 136.
- Murtagh, G. J. (1972). Seedbed requirements for *Dolichos lablab*. *Aust. J. exp. Agric. Anim. Husb.* 12: 288.
- Noonan, J. B. (1971). Silage proves its worth. *Dairy Topics* 16: 23.
- O'Brien, A. D. and Cohen, R. D. H. (1972). Naturalized white clover on the North Coast. *Agric. Gaz. N.S.W.* 83: 86.
- Read, J. W. and Witschi, P. A. (1972). Phalaris for irrigation areas in New South Wales. *Agric. Gaz. N.S.W.* 83: 14.
- Scott, B. J. (1971). Establishment of improved pastures in semi-arid areas of central western N.S.W. *Arid Zone Newsl.* 46.
- Sheridan, K. P., Holland, J. F., Thompson, J. A., and Hamilton, B. A. (1972). Growth rate of lambs and adult sheep grazing forage sorghums and lucerne. *Aust. J. exp. Agric. Anim. Husb.* 12: 144.
- Southwood, O. R. (1971). The chemical control of barley grass in dryland lucerne. *Weeds Res.* 11: 231.
- Southwood, O. R. (1971). The effect of superphosphate application, 2,4-DB and grazing on broomrape in a subterranean clover pasture. *Weeds Res.* 11: 240.
- Southwood, O. R. and Scott, R. C. (1972). Sweet lupins. *Agric. Gaz. N.S.W.* 83: 99.
- Spurway, R. A. with Park, R. J. (CSIRO), and Wheeler, J. L. (CSIRO) (1972). Flavour differences in meat from sheep grazed on pasture or winter forage crops. *J. agric. Sci. (Cambridge)* 78: 53.
- Walkden-Brown, C. and Fitzsimmons, R. W. (1971). Wheat varieties for 1972. *Agric. Gaz. N.S.W.* 82: 322.
- Walkden-Brown, C. and Fitzsimmons, R. W. (1971). Barley varieties for 1972. *Agric. Gaz. N.S.W.* 82: 360.
- Walkden-Brown, C. and Fitzsimmons, R. W. (1972). Oat varieties for 1972. *Agric. Gaz. N.S.W.* 83: 2.
- Wheatley, W. M. (1971). Thistles—prickly problem of pasture improvement. *Agric. Gaz. N.S.W.* 82: 258.
- Wolfe, E. C. and Lazenby, A. (Univ. N.E.) (1972). Bloat incidence and liveweight gains in beef cattle on pastures containing different proportions of white clover (*Trifolium repens*). *Aust. J. exp. Agric. Anim. Husb.* 12: 119.
- Woodward, R. G. (1971). Acceptability of *Trifolium glomeratum* to sheep. *J. Aust. Instit. agric. Sci.* 37: 344.
- York, F. A. (1972). Stored feedstuffs assume greater importance. *Dairy Topics* 15: 9.

Contributions to Technical Conferences

- Boerema, E. B. (1972). Methods of establishing rice and cropping systems used in a temperate climate. Aust. Rice Res. Conf., Leeton. 2: 1.
- Boerema, E. B. (1972). Emergence and seedling vigour of three rice varieties in N.S.W. Aust. Rice Res. Conf., Leeton. 2 (a): 1.
- Boerema, E. B. (1972). Comparative development and growth of in-water and drill sown rice. Aust. Rice Res. Conf., Leeton. 2 (b): 4.
- Boerema, E. B. (1972). Border effect in rice experimental plots. Aust. Rice Res. Conf., Leeton. 2 (b): 13.
- Boerema, E. B. (1972). Topdressing rice crops in N.S.W. Aust. Rice Res. Conf., Leeton. 2 (c): 14.
- Boerema, E. B. (1972). Preventing nitrogen losses during the flushing period of drill sown rice. Aust. Rice Res. Conf., Leeton. 2 (c): 17.
- Clampett, W. S. (1972). Effects of the first irrigation and harvest dates on the yield and quality of Kulu rice in the Murrumbidgee Valley. Aust. Rice Res. Conf., Leeton. 6 (a): 29.
- Colless, J. M. (1971). Development of "modified dwarf" late-maturing maize. Proc. Aust. Plant Breed. Conf., Perth. 13: 14.
- Colless, J. M. (1971). The utilization of unadapted exotic maize races. Proc. Aust. Plant Breed. Conf., Perth. 5 (b): 13.
- Colless, J. M. (1971). Progress in breeding early maturing maize resistant to northern leaf blight (*Helminthosporium turcicum* Pass.). Proc. Aust. Plant Breed. Conf., Perth. 13: 4.
- Darley, E. C. (1972). Breeding programmes in relation to commercial production. Aust. Potato Agron. Conf., Burnie. 10: 1.
- Leggett, E. K. (1972). Analysis of fertilizer trials in N.S.W. Aust. Potato Agron. Conf., Burnie. 4 (a): 8.
- Lewin, L. G. (1972). Rice germ plasm introduction in N.S.W. Aust. Rice Res. Conf., Leeton. 3 (a): 2.
- Lewin, L. G. (1972). Desiccants as an aid to rice harvesting. Aust. Rice Res. Conf., Leeton. 2 (b): 9.
- McDonald, D. J. (1971). Heterosis for rate of gross photosynthesis in rice. Aust. Plant Breed. Conf., Perth. 1 (b): 20.
- McDonald, D. J. (1972). Rice variety improvement in temperate regions. Aust. Rice Res. Conf., Leeton. 3: 1.
- McDonald, D. J., Stansel, J. W., and Gilmore, E. C. (1972). Photosynthesis in rice varieties and hybrids. Aust. Rice Res. Conf., Leeton. 3 (b): 1.
- McDonald, D. J. (1972). Moisture content of individual rice kernels and its effect on suncracking. Aust. Rice Res. Conf., Leeton. 6 (a): 28.
- Mears, A. D. (1971). Weed control in tobacco. Proc. Weeds Soc. N.S.W. 4: 3.
- Nott, M., Trounce, R., and Swain, D. J. (1972). The effect of *Cyperus difformis* on rice yield. Aust. Rice Res. Conf., Leeton. 4 (a): 2.
- Pulver, R. J. (1972). Variety evaluation in N.S.W. using particular aspects of quality evaluation. Aust. Potato Agron. Conf., Burnie. 11: 17.
- Scott, G. R. (1971). The preservation and utilization of Australian maize germ plasm. Aust. Plant Breed. Conf., Perth. 5 (b): 10.
- Sumeghy, J. B. (1971). Breeding of multiple disease resistance in vegetable crops. Aust. Plant Breed. Conf., Perth. 8: 28.
- Sumeghy, J. B. (1971). Selection for quality in breeding lines for processing tomatoes and stringless beans. Aust. Plant Breed. Conf., Perth. 9 (a): 10.
- Sumeghy, J. B. (1971). Breeding of multiple disease resistance in vegetable crops. Aust. Plant Breed. Conf., Perth. 8: 28.
- Swain, D. J. and Glennie Holmes, M. (1972). The residual effect of atrazine on a rice crop grown following sorghum. Aust. Rice Res. Conf., Leeton. 4 (b): 1.
- Toth, J. (1971). Herbicides for total vegetation control. Proc. Weeds Soc. N.S.W. 4: 8.

Post-Graduate Theses

- Cornish, P. S. (1971). Investigations into the problem of low production from Skeletal soils of the Yass Valley. M.Sc. Agr. Thesis, Univ. of Sydney.
- Wolfe, E. C. (1971). Grass—white clover relationships during pasture development and their relevance to cattle bloat. Ph.D. Thesis, Univ. of New England.

Books

- Campbell, M. H. (1972). Pasture establishment in A. Lazenby and F. G. Swain, ed., Intensive Pasture Production. Angus and Robertson, Sydney. Ch. 5.
- Colman, R. L. (1972). Fertilizers and irrigation for intensification of pasture production in A. Lazenby and F. G. Swain, ed., Intensive Pasture Production. Angus and Robertson, Sydney. Ch. 9.
- Dann, P. R. (1972). Fodder crops for sheep in Australia in J. H. Leigh and J. C. Noble, ed., Plants for Sheep in Australia. Angus and Robertson, Sydney. Ch. 17.
- Southwood, O. R. (1972). Description and evaluation of native pasture in New South Wales in J. H. Leigh, and J. C. Noble, ed., Plants for Sheep in Australia. Angus and Robertson, Sydney. Ch. 1.
- Witschi, P. A. (1972). The establishment and persistence of irrigated pastures in J. H. Leigh and J. C. Noble, ed., Plants for Sheep in Australia. Angus and Robertson, Sydney. Ch. 10.
- Wolfe, E. C. (1972). Pasture management and its effect on the botanical composition and productivity of pasture in A. Lazenby and F. G. Swain, ed., Intensive Pasture Production. Angus and Robertson, Sydney. Ch. 10.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE

BIOLOGY BRANCH

D. of A. Bulletins, Booklets, and Leaflets

Kiely, T. B., Cox, J. E., Cradock, F. W., and Barkus, B. (1972). Nutrition studies of Valencia oranges. Bull. S86.

Contributions to Journals

Ballantyne, B. J. (1971). Diseases of dry beans. *Agric. Gaz. N.S.W.* 82: 270.

Ballantyne, B. J. (1971). Summer death of beans. *Agric. Gaz. N.S.W.* 82: 295.

Ballantyne, B. J. and Pulver, R. J. (1972). The reaction of pea varieties to top yellows in N.S.W. *Agric. Gaz. N.S.W.* 83: 26.

Bertus, A. L. (1971). Control of azalea petal blight. *Agric. Gaz. N.S.W.* 82: 287, 362.

Broadbent, P., Baker, K. F. (Uni. of Calif.), and Waterworth, Y. (1971). Bacteria and actinomycetes antagonistic to fungal root pathogens in Australian soils. *Aust. J. biol. Sci.* 24: 925.

Broadbent, P., Fraser, L. R., and Waterworth, Y. (1971). The reaction of citrus species and related genera to *Phytophthora citrophthora*. *Proc. Linn. Soc. N.S.W.* 96: 119.

Broadbent, P., Fraser, L. R., and Long, J. K. (1971). Exocortis virus in dwarfed citrus trees. *U.S.D.A. Plant Dis. Repr.* 55: 998.

Broadbent, P., Waterworth, Y., and Fraser, L. R. (1972). "Sudden death", a disease of citrus on *Poncirus trifoliata* rootstock. *U.S.D.A. Plant Dis. Repr.* 56: 80.

Kable, P. F. (1971). Better control measures for brown rot. *Agric. Gaz. N.S.W.* 82: 194.

Kiely, T. B., Cox, J. E., Cradock, F. W., and Barkus, B. (1972). Nutrition studies of Valencia oranges. *Agric. Gaz. N.S.W.* 83: 20.

McLeod, R. W. (1971). Gramineous hosts of root knot nematodes from N.S.W. *J. Aust. Inst. Agric. Sci.* 37: 240.

McLeod, R. W. and Khair, G. T. (1971). The male of *Xiphinema monohysterum* Brown 1968. *Nematologica* 17: 488.

McLeod, R. W. (1972). Controlling root knot nematodes—the effectiveness of thiabendazole, methomyl, and aldicarb. *Agric. Gaz. N.S.W.* 83: 32.

Malcolm, H. D. R. (1972). Canning pears in the Murrumbidgee Irrigation Areas. *Fd Technol. Aust.* 24: 179.

Malcolm, H. D. R. (1972). Irrigation of peaches in the M.I.A. *Agric. Gaz. N.S.W.* 83: 152.

Smith, A. M. (1972). Drying and wetting sclerotia promotes biological control of *Sclerotium rolfsii* Sacc. *Soil Biol. Biochem.* 4: 119.

Smith, A. M. (1972). Nutrient leakage provides biological control of *Sclerotium rolfsii* Sacc. *Soil Biol. Biochem.* 4: 125.

Smith, A. M. (1972). Biological control of fungal sclerotia in soil. *Soil Biol. Biochem.* 4: 131.

Smith, A. M. (1972). Partial pressure of oxygen in agar media. *Trans. Brit. Mycol. Soc.* 58: 167.

Smith, A. M. (1972). Spring dead spot of couch turf in N.S.W. *J. Sports Turf Res. Inst.* 47: 54, 60.

Smith, A. M. and Murray, G. M. (1971). Diseases and frost damage in cereal crops 1970–71. *Agric. Gaz. N.S.W.* 82: 340.

Smith, A. M. and Noble, D. (1972). Effect of oxygen and carbon dioxide on the growth of two varieties of *Gaeumannomyces graminis* (Sacc.) v. Arx and Olivier. *Trans. Brit. Mycol. Soc.* 58: 499.

Walker, J. (1971). An undescribed species of *Ustilago* on *Cyperus lucidus* R.Br. in Australia with comments on Robert Brown's type collection of *C. lucidus*. *Proc. Linn. Soc. N.S.W.* 96: 99.

Walker, J. (1972). Type studies on *Gaeumannomyces graminis* (Sacc.) v. Arx and Olivier and Related Species. *Trans. Brit. Mycol. Soc.* 58: 427.

Walker, J. and Bertus, A. L. (1971). Shoot blight of Eucalyptus caused by an undescribed species of *Ramularia*. *Proc. Linn. Soc. N.S.W.* 96: 108.

Walker, J. and Smith, A. M. (1972). *Leptosphaeria narmari* sp. nov. and *L. korrae* sp. nov., two long-spored pathogens of grass in Australia. *Trans. Brit. Mycol. Soc.* 58: 459.

Contributions to Technical Conferences

Bertus, A. L. (1971). Effect of benomyl on a root attacking fungus. Aust. Plant Path. Conf., Hobart. 2 (d): 11.

Broadbent, P. (1971). Biological control of plant pathogens. Aust. Plant Path. Conf., Hobart. 3 (d): 1.

Kable, P. F. (1971). Plant protectants—new materials—fungicides. Aust. Plant Path. Conf., Hobart. 2 (a): 1.

Kable, P. F. (1971). The Hirst-Burkard spore trap: a simple method of coating melinex strips with vaseline. Epidemiology of Plant Dis. Conf., Wageningen. Preprints 1: 044.

Kable, P. F. (1971). Dispersal of conidia of *Monilinia fructicola* in peach orchards. Epidemiology of Plant Dis. Conf., Wageningen. Preprints 1: 045.

Kable, P. F. (1971). Epiphytotics of peach brown rot: role of surface wetness, criteria for a disease forecasting system. Epidemiology of Plant Dis. Conf., Wageningen. Preprints 1: 046.

Kable, P. F. (1971). The spread of *Armillaria mellea* from a single inoculum source. Epidemiology of Plant Dis. Conf., Wageningen. Preprints 1: 047.

McGechan, J. K. (1971). Certification of strawberry runner plants in N.S.W. Aust. Plant Path. Conf., Hobart. 4 (b): 7.

McGechan, J. K. (1971). The distribution of viruses causing woodiness of passionfruit in N.S.W. Aust. Plant Path. Conf., Hobart. 6: 22.

- Moore, K. J. (1971). The effect of oxygen and carbon dioxide on the growth of *Phytophthora* spp. Aust. Plant Path. Conf., Hobart. 3 (e): 19.
- Nair, N. G. (1971). Some observations on the virus disease complex of the cultivated mushroom (*Agaricus bisporus*) in N.S.W. Aust. Plant Path. Conf., Hobart. 6: 21.
- Nikandrow, A. (1971). Oxygen and the hatch of eggs of *Aphelenchoides composticola* and *Ditylenchus myceliophagus*. Aust. Plant Path. Conf., Hobart. 3 (e): 40.
- Smith, A. M. (1971). Biological control of *Sclerotium rolfsii*. Aust. Plant Path. Conf., Hobart. 3 (e): 33.
- Stovold, G. E. (1971). Root rot of safflower in N.S.W. Aust. Plant Path. Conf., Hobart. 3 (e): 31.
- Walker, J. (1971). Information recall from herbarium specimens. Aust. Plant Path. Conf., Hobart. 10: 1.
- Post-Graduate Thesis**
- Bertus, A. L. (1972). Thermotherapy of seeds with aerated steam. M.Sc. Thesis, Macquarie Univ.

CHEMISTRY BRANCH

Contributions to Journals

- Barnes, W. C. and Blakeney, A. B. (1971). A rapid colorimetric method for alpha amylase determination in wheat flour. *J. Aust. Inst. agric. Sci.* 37: 242.
- Chesterfield, R. S. (1971). A modified barley pearler for measuring hardness of Australian wheats. *J. Aust. Inst. agric. Sci.* 37: 148.
- Leece, D. R., Cradock, F. W., and Carter, O. G. (Univ. of Syd.) (1971). Development of leaf nutrient composition standards for peach trees in N.S.W. *J. hort. Sci.* 46: 163.
- Leece, D. R. (1972). Diagnostic leaf analysis for stone fruit. 1. Errors associated with standard and simplified sampling procedures. *Aust. J. exp. Agric. Anim. Husb.* 12: 315.
- Leece, D. R. and Kenworthy, A. L. (Mich. State Univ.) (1971). Effect of potassium nitrate foliar sprays on leaf nitrogen concentration and growth of peach trees. *Hort. Sci.* 6: 171.
- Leece, D. R. and Kenworthy, A. L. (Mich. State Univ.) (1972). Influence of epicuticular waxes on foliar uptake of nitrate ions by apricot leaf disks. *Aust. J. biol. Sci.* 25: 641.
- Leece, D. R., Dilley, D. R. (Mich. State Univ.), and Kenworthy, A. L. (Mich. State Univ.) (1972). The occurrence of nitrate reductase in leaves of *Prunus* species. *Plant Physiol.* (Lancaster) 49: 725.
- Siman, A., Cradock, F. W., Nicholls, P. J., and Kirton, H. C. (1971). Effect of calcium carbonate and sulphate of ammonia on manganese toxicity in an acid soil. *Aust. J. agric. Res.* 22: 201.

Contributions to Technical Conferences

- Barnes, W. C. and Blakeney, A. B. (1971). The use of chromogenic starch substrates for the assay of alpha amylase in cereal products. Proc. 21st Conf. Roy. Aust. Chem. Inst., Cereal Chem. Div., Melbourne. 237.
- Blakeney, A. B. (1972). Starch characteristics in relation to the cooking quality of polished rice. Aust. Rice Res. Conf., Leeton. 6 (a): 25.
- Blakeney, A. B. (1972). Review: grain—quality and quality control. Aust. Rice Res. Conf., Leeton. 6 (a): 8.
- Blakeney, A. B. and Barnes, W. C. (1972). Particle size importance in rice amylograms. Aust. Rice Res. Conf., Leeton. 6 (a): 24.
- Chesterfield, R. S. and Lind, P. (1971). Factors affecting the pearling resistance of N.S.W. wheats. Proc. 21st Conf., Roy. Aust. Chem. Inst., Cereal Chem. Div., Melbourne. 245.
- Leece, D. R. (1972). Foliar absorption of KNO_3 in *Prunus* spp. Proc. 13th General Meeting, Aust. Soc. Plant Physiol. 47.

ENTOMOLOGY BRANCH

Contributions to Journals

- Hamilton, J. T. (1972). *Bryobia repensi* Manson (Tetranychidae: Acar.) a new pasture pest and its control. *J. Aust. Inst. agric. Sci.* 38: 62.
- Shanahan, G. J. (1971). Insecticide resistance and the Australian sheep blowfly, *Lucilia cuprina* (Wied.). *Wool Technol. Sheep Breed.* 18: 61.

DIVISION OF MARKETING AND ECONOMICS

D. of A. Bulletins, Booklets, Leaflets

- Benson, R. J. (1971). Evaluation of the North Coast Dairy Feed Year Assistance Scheme. *D.M.A.E. Misc. Bull.* 15.
- Catt, C. B. J. and Richmond, R. N. (1971). The economics of lucerne establishment and production in the Maitland District. *D.M.A.E. Farm Planning Leaflet.* 25.
- Hodgkinson, S. A. (1972). Financial decisions necessary before entering the pig industry. *Regional Econ. Data Series*, 1.
- Hodgkinson, S. A. (1972). Budgets and market information for grain crops in the Central West of N.S.W.—Dubbo Agronomy District. *Regional Econ. Data Series*, 3.
- Hodgkinson, S. A. (1972). Budgets and market information for grain crops in the Central West of N.S.W.—Orange Agronomy District. *Regional Econ. Data Series*, 4.

- Hodgkinson, S. A. and Munro, K. J. (1972). Economic aspects of cattle fattening. *Regional Econ. Data Series*, 5.
- Kennedy, J. R. (1971). Budgets for irrigated crops in Southern N.S.W. *Econ. Inform. Series*, August.
- Kennedy, J. R. (1972). Budgets for crops in the Carrathool Shire. *Econ. Inform. Series*, March.
- Martin, K. J. (1971). Calf creep feeding. *Wagga Occasional Econ. Series*, 6.
- Munro, K. J. (1972). Growth rate tables for cattle. *Regional Econ. Data Series*, 2.
- Rance, G. A. (1971). Budget for dryland crops on the Southern Tablelands. *Econ. Inform. Series*, October.
- Richmond, R. N. (1971). Surplus milk—Does it pay? *D.M.A.E. Farm Planning Leaflet* 24.
- Richmond, R. N. (1971). The profitability of purchasing additional milk quota: Lower Hunter Area, N.S.W. *Econ. Notes*, 1.
- Richmond, R. N. (1971). The profitability of surplus milk: Lower Hunter Area, N.S.W. *Econ. Notes*, 2.
- Richmond, R. N. (1971). The profitability of purchasing additional milk quota: Taree Area, N.S.W. *Econ. Notes*, 3.
- Richmond, R. N. (1971). The profitability of surplus milk: Taree Area, N.S.W. *Econ. Notes*, 4.
- Richmond, R. N. (1971). The profitability of purchasing additional milk quota: Muswellbrook Area, N.S.W. *Econ. Notes*, 5.
- Richmond, R. N. (1971). The profitability of surplus milk: Muswellbrook Area, N.S.W. *Econ. Notes*, 6.
- Richmond, R. N. and Catt, C. B. J. (1971). The economics of purchasing additional quota for milk production, Lower Hunter Valley, N.S.W. *D.M.A.E. Farm Planning Leaflet* 23.
- Sibree, J. M. (1972). The economics of using lupins in pig rations. *Wagga Occasional Econ. Series*, 7.
- Sibree, J. M. (1972). Budgets for dry land cereal and oilseed crops in Southern N.S.W. *Wagga Occasional Econ. Series*, 8.

Contributions to Journals

- Buffier, B. D. (1972). Adjustments in agriculture. *Agric. Gaz. N.S.W.* 83: 34.
- Burgman, R. J. (1972). United Kingdom entry into the European Economic Community and implications for Australian agricultural industries. *Agric. Gaz. N.S.W.* 83: 6.
- Catt, C. B. J. (1971). The farm management consultant. *Agric. Gaz. N.S.W.* 82: 230.
- Davis, J. (1972). Some effects of supply control of egg production. *Poultry Notes*, January: 1.
- Duncan, R. C. (1972). Technological change in the arid zone of N.S.W. *Aust. J. agric. Econ.* 16: 22.
- Mohr, G. M. (1972). The bulk constraint and computer formulations of least-cost feed mixes. *Rev. Mktg. agric. Econ.*, Sydney 40: 15.
- Rance, G. A. (1971). A dairy demonstration farm for the South Coast. *Agric. Gaz. N.S.W.* 82: 220.
- Richmond, R. N. (1971). The economics of coastal irrigation schemes: A case study. *Rev. Mktg. agric. Econ.*, Sydney 39: 26.
- Richmond, R. N. (1972). The effect of flooding on farm income. *Agric. Gaz. N.S.W.* 83: 17.
- Standen, B. J. (1972). Measurement of the efficiency of resource use on farms and the welfare of farm people. *Aust. J. agric. Econ.* 16: 34.
- Trebeck, D. B. (1971). Spatial diversification by beef producers in the Clarence Region. *Rev. Mktg. agric. Econ.*, Sydney 39: 15.
- Trebeck, D. B. (1971). Future export markets for Australian beef. *Agric. Gaz. N.S.W.* 82: 329.
- Vere, D. T. (1972). Maintaining sheep during drought with computer formulated rations. *Rev. Mktg. agric. Econ.*, Sydney 40: 79.
- Vere, D. T. (1972). Economics of alternative drought strategies in sheep production. *Agric. Gaz. N.S.W.* 83: 48.
- Vere, D. T. and Saville, D. G. (1972). Drought feeding of sheep. *Agric. Gaz. N.S.W.* 83: 102.

Contributions to Technical Conferences

- Kennedy, J. R. (1972). Profitability of ricegrowing in the Murrumbidgee Irrigation Area. *Aust. Rice Res. Conf.*, Leeton. 8 (a): 3.

Other Publications

- Maccallum, D. E., Burns, E. O. (QDPI), and Potter, J. N. (1972). Extension in farm business management, a report for Standing Committee on Agriculture. Dept. Prim. Ind., Canberra.

Post-Graduate Theses

- Duncan, R. C. (1972). The gains from pasture research in Australia: An economic analysis of research in the CSIRO Division of Plant Industry. Ph.D. thesis, Aust. Nat. Univ.
- Ryan, J. G. (1972). A generalized crop-fertilizer production function. Ph.D. thesis, North Carolina State Univ.
- Standen, B. J. (1972). An assessment of adjustment problems in North Coast dairy farming. M.Ag.Ec. thesis, Univ. of New England.
- Trebeck, D. B. (1971). Spatial diversification by beef producers in the Clarence River Valley. M.Ec. thesis, Univ. of New England.

DIVISION OF RESEARCH SERVICES

D. of A. Bulletins, Booklets, Leaflets

- Pharaoh, D. M. (1972). A bench grinder for farm workshops. *Bull. R1*.

Contributions to Journals

- Finlayson, W. H. (1972). Rice production equipment. *Ricemills News* 9: 25.
- Garland, P. J. (1972). Sunflower trays. *Power Farming and Better Farming Dig.* 81: 4.
- Holligan, P. J. and Scott, K. J. (1971). A prefabricated plastic room and open flame generator for the controlled atmosphere storage of apples. *Fd. Technol. Aust.* 23: 336.
- Holligan, P. J. and Scott, K. J. (1972). Low-cost controlled atmosphere storage for pome fruits. *Agric. Gaz. N.S.W.* 83: 138.
- Holligan, P. J. and Mead, J. A. (1971). Tobacco mechanisation in Queensland and Victoria. *Aust. Tobacco Growers Bull.* 19.
- Pharaoh, D. M. (1971). A bench grinder for the farm workshop. *Agric. Gaz. N.S.W.* 82: 363.
- Pharaoh, D. M. (1971). Electric fences for worthwhile savings. *Power Farming and Better Farming Dig.* 80: 79.
- Pharaoh, D. M. (1972). Permanent electric fences. *Dairy Topics* 17: 14.
- Stone, J. G., Wade, N. L., and Beattie, B. B. (1971). Controlling post harvest rots of peaches. *Agric. Gaz. N.S.W.* 82: 375.

Contributions to Technical Conferences

- Garland, P. J. (1972). Mechanical damage to potatoes. Aust. Potato Agronomy Conf., Burnie. 8: 5.

Other Publications

- Whiston, W. D. (1971). Australian national machinery field days programme and catalogue of farm machinery. *Central Western Daily Press*.

AGRICULTURAL RESEARCH INSTITUTE, WAGGA WAGGA**Contributions to Journals**

- Cuthbertson, E. G. (1971). Transmission and persistence of the vernalization stimulus in *Chondrilla juncea* L. *J. Aust. Inst. agric. Sci.* 37: 156.
- Kuiper, J. (1971). Effect of *Septoria tritici* on yield of Robin wheat. *Aust. Cereal Agron. Res. Newsl.* 6: 54.
- Kuiper, J. (1971). Effect of net blotch on yield of barley. *Aust. Cereal Agron. Res. Newsl.* 6: 55.
- Taylor, A. C. and Gilmour, A. R. (1971). Wheat protein prediction from climatic factors in southern N.S.W. *Aust. J. exp. Agric. Anim. Husb.* 11: 546.
- Taylor, A. C. (1971). Wheat protein in the south. *Agric. Gaz. N.S.W.* 82: 344.
- Warren, J. F. (1971). Variety trials, variety changes and commercial wheat yields in N.S.W. *J. Aust. Inst. agric. Sci.* 37: 303.

AGRICULTURAL RESEARCH DIRECTORATE, TAMWORTH**Contributions to Journals**

- Evans, G., Single, W. V., Thompson, J. A., and Sheridan, K. P. (1972). A low-cost glasshouse for research. *J. Aust. Inst. agric. Sci.* 38: 49.
- Holford, I. C. R. (1971). Comparative requirements of sulphur by cereals and legumes. *Aust. J. agric. Res.* 22: 879.
- Single, W. V. (1971). Cold stress and wheat production. *Field Crop Abs.* 24: 608.
- Single, W. V. (1971). Frost damage in wheat crops. *Agric. Gaz. N.S.W.* 82: 211.
- Single, W. V. with Banath, C. L. (Univ. of Qld.) (1972). Effects of sulphur and nitrogen deficiencies on freeze resistance in wheat plants. *J. Aust. Inst. agric. Sci.* 38: 138.
- Single, W. V. with Banath, C. L. (Univ. of Qld.) (1971). Effect of sulphur and nitrogen deficiencies on freeze resistance in wheat. *Agric. Gaz. N.S.W.* 82: 307.
- Symes, K. J. (1972). The Australian Wheat Collection. *Agric. Gaz. N.S.W.* 83: 148.
- Wark, Barbara M. with Matheson, E. M. (Univ. of N.E.) (1972). Duramba—a new semidwarf durum wheat for the North-West of N.S.W. *Agric. Gaz. N.S.W.* 83: 170.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM**Contributions to Journals**

- Chew, W. L. (1972). The genus *Piper* (Piperaceae) in New Guinea, Australia and Solomon Islands 1. *J. Arnold Arbor.* 53: 1.
- Jacobs, S. (1971). The systematic position of the genera *Triodia* R. Br. and *Plectrachne* Henr. (Gramineae). *Proc. Linn. Soc. N.S.W.* 96: 175.
- Johnson, L. A. S. (1972). Evolution and classification in *Eucalyptus*. *Proc. Linn. Soc. N.S.W.* 97: 11.
- McGillivray, D. J. (1971). *Apatophyllum*: an interesting new Australian genus in the family Celastraceae. *Kew Bull.* 25: 401.

Contributions to Technical Conferences

- Blaxell, D. F. (1971). The orchids of Australia—the eastern temperate region. Proc. 6th World Orchid Conf., Sydney, 1969. 25.

